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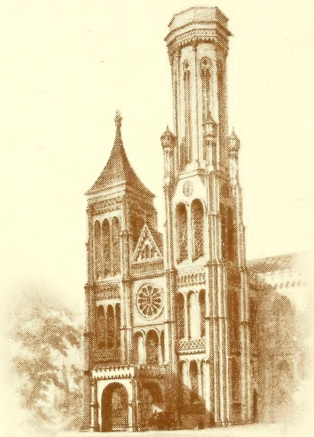

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AN ILLUSTRATED MONTHLY

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VOL. XXI, NO. 7 WASHINGTON JULY, 1910

THE NATIONAL GEOGRAPHIC MAGAZINE

THE DATE GARDENS OF THE JERID

BY THOMAS H. KEARNEY

With Photographs by the Author

"WITH its feet in the water and its head in the fire," as the Arab proverb has it, the date palm is at home in the vast deserts that stretch from Morocco to the borders of India.

It thrives where the air is almost absolutely dry and where the summer temperatures are the highest on the globe. Under these conditions only do the best varieties of dates reach perfect ripeness. But as it is also necessary that the roots of the palm find plenty of moisture in the soil, the fruit is confined to the oases—favored spots in the deserts where never-failing springs or wells allow of irrigation.

No country is more celebrated for the excellence of its dates than the Beled el Jerid (Land of the Palms), a small group of oases situated at the northern edge of the Sahara and distant about 250 miles southwestward as the crow flies from the city of Tunis.

Some years ago I visited these oases in order to obtain palms for the date orchards which the National Department of Agriculture has established in Arizona and in the Colorado Desert of California.* My visit was so timed that I reached the oases soon after the beginning of the harvest. This made it possible to test the fruit of the different varieties while fresh from the trees and to select the best of them for introduction into the United States.

The Jerid is best reached by means of a railway which crosses southern Tunis from the busy little seaport of Sfax, on the east coast, to the rich phosphate mines of Metlaoui, near the Algerian frontier.

Leaving Sfax one morning in October, an all-day journey in a slow mixed train brought me to Gafsa, 25 miles from the end of the line. It was a desolate country through which we passed, wonderfully like the high plains of eastern Colorado and New Mexico.

An occasional cluster of "gourbis," or tents of skins, an occasional flock of multicolored sheep and goats, tended by half-wild Bedouin children, were the only signs of life in the monotonous landscape. The vegetation consisted

* In the southwestern United States there are deserts as hot as the Sahara. Rivers and artesian wells supply water for the irrigation of many thousands of acres. In the belief that the physical conditions meet all the requirements of the palm, the Department of Agriculture is devoting much energy to establishing date culture in this region. During the past ten years agricultural explorers have visited many parts of the great desert zone of the Old World in search of the best varieties.

MARKET PLACE AT TOZER

chiefly of brown clumps of the grass called "alfa" or "esparto," the long tough leaves of which are pulled by hand and shipped in bales to Europe for making baskets, straw hats, and paper of fine quality.

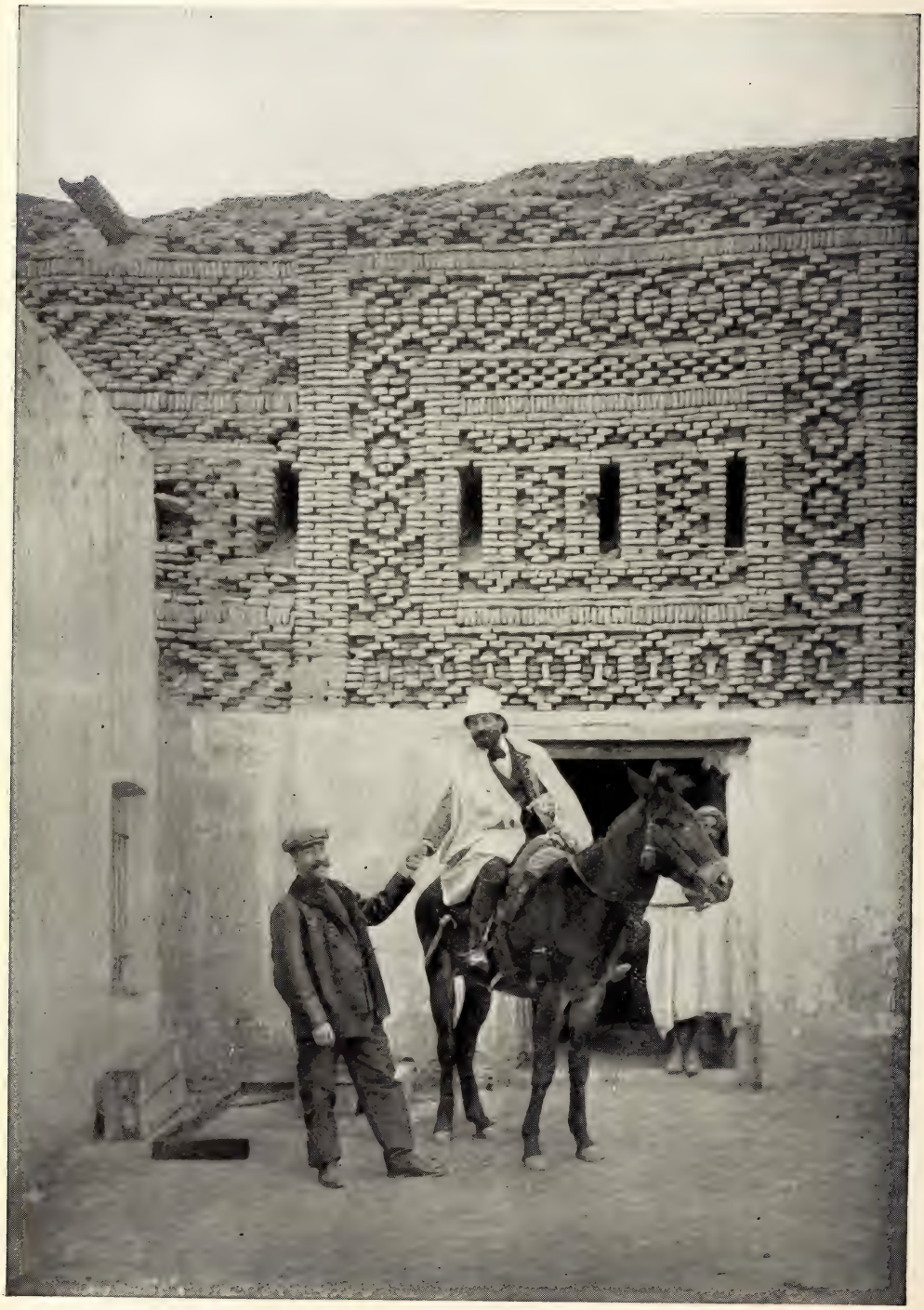
After spending the night at Gafsa, I was up betimes and took an early train to Metlaoui, the terminus of the railway. Here I was met by two Arab boys with donkeys sent by the Contrôleur Civil from Tozer, the chief town of the Jerid. A discharged soldier, returning to his oasis home at the expiration of his service in a regiment of "spahis"—the Franco-Tunisian cavalry—invited himself to join our company. It was a 35-mile ride over the desert from Metlaoui to Tozer.

Although late in October, the heat was intense. The road—a mere track and hardly distinguishable—followed part way the stony bed of a dry "oued," and then struck out across the desert. Overhead was the cloudless sky, underfoot the blazing sand, and around us the sharp forms of desert mountains, devoid of soil and trees. At midday we lunched in the scanty shade afforded by the mud brick walls of a little "bordj," a walled enclosure where travelers may encamp and, if need be, defend themselves against marauders.

The Arabs, who had hitherto beguiled the way with gutteral chatter and laughter and occasionally with a nasal chanting that kept time to the jog trot of the donkeys, were silent during the long, hot afternoon. Towards evening the air freshened and our tired animals quickened their steps. Alighting for a moment, Yusuf ben Mohamed, the ex-spahi, adjusted his fez with the aid of a pocket looking glass. Then, taking from his wallet a sash of crimson silk and giving one end of it to the donkey boy, he turned round and round until it was neatly wrapped in many folds about his waist. We were evidently nearing the end of our journey.

A few minutes later we paused on the brink of a deep ravine and saw before us—sharp and black against the red evening sky—a long fringed line of palm crowns. It was the oasis of El Hamma, the first of the Beled el Jerid. We skirted a corner of this oasis, passed through its

Dates grow in large bunches which contain hundreds of the fruit. Some of the clusters are so heavy that the fruit must be straddled on the nearest leaf stalk (as in this illustration) to prevent the stem of the cluster from being broken by the weight.



THE HOUSE AT TOZER IN WHICH THE AUTHOR ROOMED FOR SIX WEEKS

TOMB OF A MOHAMMEDAN SAINT AT THE EDGE OF TOZER OASIS

mud-brick village, and, after 9 miles more of donkey back, reached Tozer.

It was none too soon, for I was well nigh exhausted with the fatigue of bestriding all day the huge padded saddle on which the Arabs generally sit cross-legged. After a hasty dinner, I was installed in the one-storied house, built around three sides of an open courtyard, which was to be my home for the next six weeks.

In the morning the first duty was to present my credentials to the French administrator of the Jerid region. That functionary, who enjoys the double title of "Contrôleur Civil" and "Vice-Consul," received me courteously and detailed a spahi to accompany me in my explorations of the oases. Mounted on a fine gray horse and wearing a uniform consisting of a sky-blue burnous over a white "haik" or jacket, my guide made a picturesque figure. The one-eyed El Hachemi ben Achmid, who spoke passable French, was engaged as interpreter, and was thereafter a constant attendant during my stay in the Jerid. A scrawny boy who carried the camera completed the retinue, and without further loss of time we started for the gardens. Crossing the open market-place, on which face the modest public buildings, and winding through a series of narrow, crooked streets, we soon found ourselves on the outskirts of the town. Here, in a shallow stream, naked children were disporting themselves, and women, with skirts tucked up above their knees, were washing clothes. We then traversed a few rods of bare sand and plunged into the oasis.

The transition from the blinding glare outside to the cool shade of the gardens was delightful. Entering one of them, we found it a jungle of date palms, planted in no apparent order, some so close that the stems almost touch, and in other places far enough apart to leave room for little patches of vegetables and lucern and tender young barley. Beneath the tall palms there were other trees—figs, apricots, and olives.

Huge grape vines hung in festoons from the trunks, and long runners of melon and cucumber trailed over the ground. Here and there oranges and

THE TOWN OF NEFTA

The town is built on higher ground than the date gardens, which are unhealthy to live in (see page 554)

big rosy pomegranates gleamed in their setting of dark glossy foliage, and the jasmine, with its white corollas, starred the semi-twilight. Beds of scarlet peppers glowed like fires in the deep shadows among the trees.

The first garden we visited was the property of a wealthy sheik, who was waiting to receive us. The old gentleman's wrinkled brown face, picturesquely framed in the snowy folds of a huge turban, was all alight with cordiality as he led us, with many a greeting of "Salam" and "Sahha" (health), to a hut in the center of the grove. There were assembled his gardeners or "khammes." They were dark-skinned, sullen-looking men, clad in shirts and short baggy trousers of coarse blue cotton cloth, with arms and legs bare. A brief order from their master sent them scampering up the scaly palm trunks. In a few seconds they were with us again, the loose folds of their shirts bulging with dates of many kinds.

The harvest was already in progress, and it was interesting to watch the manner of gathering the fruit. Dates grow in large bunches, weighing from 10 to 40 pounds, which hang beneath the crown of leaves on long yellow or orange-colored stalks, hard and polished as ivory.

An expert workman, known as the "getaa," climbs to the top of the palm, gripping the scaly bark with his bare toes. He is armed with a "mengel," an iron knife, having a heavy serrated blade at right angles to the shank, which is set in a wooden handle.

Severing the stalk with a stroke of his knife, he gives the heavy cluster to the man who straddles the trunk just under him. It is then passed from hand to hand by men and boys who cling to the tree, one below the other, until it reaches the ground.

The number of the rungs in this human ladder depends, of course, upon the height of the palm. Sometimes seven or eight men beside the getaa are required.

Only the best varieties of dates are handled thus carefully; for the ordinary sorts it suffices to toss the cluster to the ground, where they are caught in sheets. They are then packed in skins or baskets to be kept for local consumption, or they are exchanged for wheat and barley, which the nomads of the high central plateaux of Tunis and Algeria bring down to the oases in the fall on the backs of their camels.

The fine Deglet Noor dates, of which the Jerid exports from one to two million pounds every year, are prepared for shipment before leaving the gardens. No curing is necessary. The divisions of the clusters are separated, the unripe and the spoiled fruit is culled, and the dates are packed on the branch in the wooden boxes in which they are despatched by parcels post to Europe. The finest are afterwards selected and arranged in the small oblong boxes, decorated with gaudy lithographs of palm trees and camels, that are seen in our fruit shops at Christmas time.

Riding back to Tozer at noonday for luncheon and siesta, we could make but slow progress because of the crowds that thronged the bridle paths among the gardens. Here and there where two roads crossed were stationed venders of broad beans. The beans, almost as large as chestnuts and not unlike them in flavor, were boiled in petroleum tins over charcoal fires and were sold hot to laborers and idlers.

The air was resonant with the shrill "ir-r-r-a" of the donkey boys and the shouts and songs of men and children. For the time of date harvest is a halcyon season in the Beled el Jerid. The long hot summer is over. The days are still comfortably warm and the nights just cool enough to be bracing. Dates are to be had for the asking, and all the world is well fed and contented.

In the afternoon we sallied forth for another visit to the gardens, returning through the cool twilight. Then for the first time I could appreciate the full beauty of the oasis. The level rays of the setting sun lit up the palm tops, turning the dull purples and maroons of the fruit clusters to glowing crimson and their stalks to burnished gold. Against

A GREAT ORCHARD OF DATE PALMS AT NEFTA (SEE PAGE 551)
Note the hollow in which the palms grow

Photo by F. Soler

the clear beryl green of the eastern sky the feathery leaf crowns were silhouetted. Overhead a star or two began to glisten in the azure that was fast changing to dusky violet.

Day after day of the delightful Saharan autumn was spent in these explorations, so that I soon became familiar with the topography of the region. The Jerid oases are four in number. Tozer and Nefta, which comprise about 6,000 acres each, are the largest. They are separated one from another by a few miles of sandy desert, where stunted gray bushes are the only vegetation during the greater part of the year. Immediately behind the oases rises a steep bluff, which here forms the northern boundary of the Sahara. The date gardens occupy a gently sloping shelf about one mile wide between this and the Shott el Jerid, a great shallow pond, usually covered with a glittering crust of salt and containing water for only a brief time after the infrequent winter rains. It is one of a chain of such dry lakes that stretches from near the eastern coast of Tunis to the Oued Rir country a few miles south of Biskra, in Algeria.

There are said to be nearly one million date trees in the Jerid. Each oasis is a dense forest, of which the ownership is much divided. The individual holdings range in size from a few square rods to several acres and are separated by "tabias," walls of dried mud surmounted by a palisade of the thorny palm leaves.

Numerous springs, gushing forth at the base of the escarpment that shelters the oases from the north winds, furnish an abundant and constant supply of water for irrigation. At Nefta the springs are situated in a deep basin, of which the sides are much higher than the tallest palm in the beautiful grove that covers its floor. This is the "Ras el Aïn" (Head of the Spring), which the French call the "Corbeille" or basket.

At Tozer and at Nefta the water of the springs is gathered into one large canal. It is then diverted by means of dams situated at convenient points into the irrigating ditches that penetrate every corner of the oasis. Long, shallow notches are cut in the palm log that forms the weir, and the number, length, and depth of these notches determines the amount of water received by the several divisions of the canal. Two guards are stationed day and night at each weir to regulate any dispute that may arise over water rights. To facilitate irrigation, the gardens are divided into little plots or basins, separated by low mud dikes.

More than one hundred distinct varieties of dates are grown in these four small oases. There is a bewildering amount of diversity in the shape, color, and flavor of the fruits. Some are round as apples, others egg-shaped, others finger-shaped. They range in size from that of a small hazel nut to the bigness of a man's thumb. When ripe they are of every imaginable hue, from golden brown to prune purple, and even jet black.

Very fanciful are the Arab names of many of the varieties: "bride's finger," "father of the cucumber," "ox brain," "pigeon egg," "gazelle's horn," are literal translations.

Some kinds are hard and dry, only moderately sweet, and have a nutlike flavor. These "dry dates," which can easily be kept for a year or more, are a staple article of food throughout northern Africa and southwestern Asia. They form a compact and nutritious ration, especially suitable for carrying on the long caravan journeys.

Other kinds, soft as butter and dripping with syrupy juice, must be eaten the moment they ripen. The excessively rich and sweet sorts are used only as a dessert.

The Deglet Noor—the name is sometimes translated "Date of the Light"—is the only variety exported in large quantity from Tunis to Europe and America. It is neither an extremely dry nor a very soft fruit, but has a firm, clean flesh, translucent as cloudy amber, and can be kept in good condition for several months after it is harvested. The inimitable

ENTERING ONE OF THE GARDENS WE FOUND IT A JUNGLE OF DATE PALMS

Photo from David Fairchild

AN IRRIGATING CANAL IN A DATE ORCHARD

flavor of this variety is the standard of excellence in dates.

No farmer's boy is more of a connoisseur in the qualities of the different kinds of apples in his father's orchard than are the Jeridis with respect to dates. Each of the best varieties has its partisans, and there is keen rivalry among the proprietors of gardens in extolling the merits of their favorite trees. The choicest fruits are picked one by one as they ripen in the clusters and are kept by the owner for his own table and for gifts to his friends.

One of the finest of all dates, rivaling the Deglet Noor in flavor and much larger, is the "Menakher," an extremely rare variety peculiar to the Jerid. When I sought to learn why a date which they esteem so highly should be so nearly extinct, the natives told a story that is a curious commentary on the state of Tunis before the French occupation. The Beys, it seems, were exceedingly fond of Menakher dates, and no other sort was served at their banquets. Each year, at the time of harvest, their agents visited the oases and took possession of the entire crop, usually without paying for it. The people wearied finally of this extortion and ceased to plant Menakher palms. They went even further, cutting down many of the old trees in their gardens.

The towns of the Jerid are situated on higher ground just outside the oases. They thus escape to some extent the malaria that lurks in the gardens, where frequent irrigation keeps the soil constantly moist. Even the gardeners dwell mostly in the villages and trudge every morning to the scene of their labors. Only during the ripening season, when the fruit of the choice varieties must be guarded against thieves, men camp among the trees in little palm-leaf tents, which are sometimes elevated on posts at a corner of the wall to afford a better lookout.

The houses are of sun-baked brick, similar to the Mexican adobe. In the façades of the more pretentious buildings the bricks are arranged in curious geometrical patterns, the only attempt at exterior ornamentation. The indispensable date palm furnishes whatever wood is needed in construction. The narrow streets are frequently arched over, making a deep shade that is very grateful at noonday. Benevolent householders sometimes place benches outside their doors in these arcades, where any passer-by is welcome to repose himself.

The population of the Jerid numbers about 30,000 souls, whose livelihood depends almost entirely upon the product of their palms. The Jeridis are sedentary, seldom venturing far from the shelter of the oases. They do not wander over the plains with flocks and herds as do the Bedouins farther north, nor are they conductors of caravans like their Algerian neighbors, the Soufis. They are a peaceable folk, and ever preferred paying tribute to making armed resistance in the days when the Touaregs and other warlike tribes of the Sahara were wont to raid the oases. They have lived for unnumbered centuries in the villages where we find them today, desiring no occupation but the care of their date gardens.

The beauty of their gardens was celebrated by the Arab geographers of the Middle Ages. In yet earlier times, when Tozer was the Roman Thusuros and Nefta was called Nepte, the oases existed, although possibly the olive rather than the date palm was then the principal tree.

Like nearly all successful agricultural populations of the Barbary States, the inhabitants of the Jerid are primarily of Berber stock, belonging to the race that peopled northern Africa before the coming of the Phœnicians and the Romans. But there is a large admixture of other racial elements, notably of the Arab and negro. The small tradesmen and handicraftsmen are mostly Jews. One even sees occasional individuals who have fair hair, blue eyes, and a light complexion, inherited perhaps from some Vandal conqueror or Christian slave of a later epoch.

A charming little denizen of the villages is the sparrow that nests in the

THE GARDENS ARE DIVIDED INTO SMALL PLATS BY MEANS OF LOW DIKES OF EARTH TO FACILITATE IRRIGATION

TURNING OVER THE RICH BLACK SOIL WITH THE MESSAH OR SHORT-HANDLED HOE, WHICH IN THE OASES DOES ALL THE DUTY OF A PLOW AND CULTIVATOR

(SEE PAGE 557)

chinks of the mud-brick walls. This is not our dingy city bird, but a glorified sparrow, who wears a dainty dress of russet and steel blue. Earliest dawn arouses him to cheerful twitterings and occasional snatches of sweet song. The Arabs call this bird the "Bou Habibi," the "Father of Friends," and believe that he brings good luck to any house in which he makes his nest. He is strictly a town dweller, never venturing into the desert and seldom met with in the gardens. Nothing in common has he with such nomads as the linnet and the skylark. He will not live in captivity, and attempts to naturalize him no farther away than the city of Tunis have always failed.

The Ramadan, the Lent of the Mohammedans, commenced ere I had been many weeks in the desert. From sunrise to sunset the natives took neither bite nor sup. By the middle of the afternoon the people of Tozer would be faint with hunger, and huddled in silent groups at the edge of the town, watching the sun as if conjuring it to hasten its setting. The moment it disappeared, the signal was given by a small cannon installed for the purpose in the market place.

Instantly all was noise and motion. Fires were lighted everywhere. The air was filled with the grateful odor of cooking. Lamps were hung out on the minarets and laughter and song resounded from every house. Most of the population devoted the entire night to revelry and were unfit for work in the daytime. The feast of the "Little Bairam" follows the month of fasting, and it was during those three days of childish merrymaking that I left the Jerid for a season.

Early in February I alighted once more from the "train mixte" at Metlaoui and rode southward across the desert. It was a brilliant day, the sky blue as turquoise, the air soft and warm. Crested desert larks, near relatives of the European skylark, rose at every few steps, scattering showers of low plaintive notes. This lark and the little black and white "Comforter of the Camels" were the only birds I saw in the open desert.

When I reached Tozer the gardens wore a changed aspect. The palms were bare of fruit. Here and there among their rough brown trunks gleamed the tender pink of blossoming apricots. The buds of the fig trees were beginning to disclose the lovely green of their young leaves. Hosts of linnets sang all day long in the palm tops, recalling the choirs of gold finches on May mornings at home. Gardeners, stooping low to their work with the "messah," the short-handled hoe, which in oasis agriculture does all the duty of plow and cultivator, were turning over the rich black soil.

The object of this second visit was to purchase and prepare for shipment the palms that had previously been selected for introduction into the United States. The date, be it said, like the apple and other fruit trees, does not "come true from seed." There is almost infinite diversity among the seedlings, with small chance that any will bear fruit exactly like that of the parent tree. It is only by taking up and planting the leafy shoots that spring from the base of a palm that the variety can be maintained unchanged.

The offshoots are fit to be removed and planted when they have begun to form roots of their own. The Jeridis say they are at their best for starting a new tree when their trunks are of the size of a camel's head. The oasis gardener, when about to take up one of these baby palms, first trims back its outer leaves, so that only two feet or so of the thorny stalks remain. He next digs a hole around and beneath it, severing its roots. With a heavy chisel he proceeds to divide it from the parent trunk. The roots are then cut off close to the stump and the offshoot is ready to be planted.

If it is to be transported to a distance, the base of the little palm is dipped in puddled clay to poultice its wounds. It is then snugly wrapped in several layers of "lif," a coarse brown-matted fiber that grows around the bases of the leaf stalks of the date. The wrapping of lif is secured by cords plaited from the same material. So wrapped, a healthy offshoot can be shipped without risk to the ends

A "SOFT" TYPE OF DATE (TRONJA), WHICH KEEPS FAIRLY WELL

Some are round as apples, others egg-shaped, others finger-shaped. They range in size from that of a small hazelnut to the bigness of a man's thumb (see page 551)

of the earth. It is by virtue of this simple method of packing that the Department of Agriculture has succeeded in introducing many of the choicest varieties of dates into Arizona and California.

Several weeks were spent in getting together the collection of palms, for the rarer sorts had to be sought far and wide. Of certain varieties but a single offshoot could be had in any one oasis. Only a few of the most popular kinds are found in some of the orchards, while others are veritable botanical gardens, containing a tree or two of almost every variety known in that part of the Sahara. Such is the celebrated garden at Nefta that once belonged to the sovereigns of Tunis.

A special quest was made for the Menakher, the royal date which was formerly reserved for the table of the Beys. But, after ransacking the Jerid, only nine plants could be obtained. One of these was a present from Si Brahim ben Mohamed el Ouadi ben Ouidi, a magnate of Nefta. After infinite coaxing, the great man came one morning, with the carefully wrapped offshoot in his arms, holding it as tenderly as though it were an infant in brown swaddling clothes. But even then the honor of presenting to the American Government a date palm of this rare variety had to be painted in the most glowing language my interpreter could command before Si Brahim was persuaded to part with his treasure.

The entire collection, some eight hundred offshoots, was at last ready for shipment. Four score camels were needed to convey the palms across the desert to the railway. With the drivers, many of whom were followed by their wives and children, it was a rather imposing caravan that assembled one morning at Tozer. Ten additional camels were to join the main body when it should reach El Hamma. Meanwhile a cold north wind sprang up, filling the air with dust and sand. Late in the evening came word that the El Hamma contingent refused to set forth in the face of the storm. This was unwelcome news, for

An expert workman, known as the "getaa," armed with a "mengel," an iron knife having a heavy serrated blade, with which he cuts off the bunch of ripe dates (see page 549)

The ordinary sorts of dates are exchanged for wheat and barley which the nomads of the high central plateaus bring down to the oases in the fall (see page 549)

PACKING THE DATES FOR SHIPMENT: ALL THE BEST DATES ARE EXPORTED

THE TALL MINARET OF THE MOSQUE IN AN OASIS TOWN

arrangements had been made to ship the palms by a steamer that was due to sail from Sfax within a few days. In this emergency I consulted the Caid of Tozer, the principal native official of the Jerid. He took prompt and decisive action, at once despatching a spahi with imperative orders to the refractory camel drivers to proceed without delay.

When I reached El Hamma early the following morning, I learned that this emissary had tried first persuasion, then threats, and at length had resorted to blows. A sound drubbing convinced the recalcitrants that the weather was not sufficiently inclement to prevent traveling, and at midnight they departed. I soon overtook them and found them

By the middle of the afternoon the people would be faint with hunger and huddled in silent groups at the edge of the town, watching the sun (see page 557)

SCENE IN AN OASIS TOWN Photo from Bishop J. C. Hartzell

Photo from Bishop J. C. Hartzell

CHILDREN OF [illegible] DATE GARDENS

CAMEL WITH LOAD OF DATE OFFSHOOTS PRESENTED BY THE PEOPLE OF THE OASES TO THE UNITED STATES GOVERNMENT

It required 90 camels to carry all the offshoots across the desert to the railway

marching along dejectedly, for not only were their shoulders still aching from the beating of the night before, but they would have to pay a fine of one franc for each kilometer traveled by the spahi who administered the punishment. Such, El Hachemi assured me, was the law of the country.

At noon I came up with the main caravan, which was traveling in very open order. The camels were walking side by side and browsing as they went, while the drivers plodded afoot through the sand. The sheik or leader was a tall, well-set-up Soudanese, with skin as black as ebony. But most of the drivers were natives of the Souf oases, who have almost a monopoly of this vocation in the Algerian and Tunisian Sahara. Their sturdy limbs and dark, smiling faces offer a striking contrast to the lank forms and sullen, anæmic visages of the stay-at-home residents of the Jerid.

When the sun dipped below the horizon that afternoon the last camel had been unloaded at Metlaoui, and the palms were stowed away in the freight cars that waited to carry them to the coast. The drivers from El Hamma, who had made remarkable speed at the last, went away rejoicing when they learned that their fine would be remitted. A few days afterward I had the pleasure of watching the good ship Tafna as she steamed out of the harbor of Sfax with the cargo of date offshoots snugly reposing under tarpaulins on her deck.

Ten weeks passed by, and the little trees reached their journey's end in the new oases of the American Sahara. They were soon safe in the ground, alongside their cousins from the banks of the Nile and from Muscat and far-away Bagdad.

With the blazing sky of the desert once more above them and the life-giving water about their feet, they are growing and ripening their fruits as if there were no 8,000 miles of land and sea between them and the mother palms of the Jerid.

GATHERING THE DATE HARVEST Photo by F. Soler

The top man hands the heavy cluster to his fellow just beneath, by whom it is passed from hand to hand until it reaches the ground. Note the oranges growing under the palms

CARRYING WATER THROUGH A DESERT

The Story of the Los Angeles Aqueduct

By Burt A. Heinly

GOD sowed the Mojave from an almost empty hand, they say, and so perhaps He did. For a few weeks of early spring this desert blooms as a paradise, but the blossoms bring no fruits. Quickly the broad acreage of flowers relapses into the sullenness of mile on mile of yellow sand, scorched day after day from the heat of a glaring sun. The rattlesnake finds protection in the narrow shade of the sage brush. With the exception of the lizard, other creeping things seek their holes and come forth after dark. Death Valley lies within Mojave's depths, while the western confines are bounded by the Sierra, into whose canyons run windrows of sand like fingers groping in the dark.

It is almost paradoxical that one of the most Titanic struggles ever undertaken by a municipality is being carried on within this desert waste, and the struggle is one for water.

At the northern outpost of the Mojave's sands a river, after gathering the drainage of the snow-clad Sierra for more than 150 miles, flows into an alkaline sink and wastes its fatness in evaporation from the sun's heat. One hundred and fifty miles across the Mojave, straight southward as the crow flies, rises the mountain wall of the Coast Range. Beyond lie foothills undulating into valleys, and a broad coastal plain on which nestle nearly 100 communities about the central metropolis of Los Angeles.

It is the plan of Los Angeles to carry the waters of this river and its tributary streams 250 miles southward across the Mojave Desert, beneath the Coast Range, and into the San Fernando Valley, where the precious fluid will be used to quench a city's thirst, to irrigate thousands of acres of rich soil now non-productive for want of moisture, to develop electrical energy to light her buildings and her streets, and furnish power for manufacturing industry on a scale new to the Pacific Coast.

The enterprise is now in the third year of its accomplishment, and will require from two and one-half to three more years for its completion. Five thousand men working through the blinding heat of the summer day and the blessed coolness of the desert night could tell the story better than pen can write.

THE CITY DOES ALL THE WORK WITH ITS OWN WORKMEN

Mr John R. Freeman, the eminent hydraulic engineer, who is known for his connection with the Panama Canal and the New York Aqueduct, in describing the features of the project to a body of Boston engineers recently, classed the Los Angeles Aqueduct as the most interesting hydraulic construction now under way on the American continent. It is not the largest. The Panama Canal, the New York Aqueduct, and the Erie Barge Canal all outrival it in the order named, but in not one of these are to be found the features which make this project so spectacular in construction and so full of promise after completion.

The enterprise is not alone interesting because of the magnitude and the seemingly insurmountable difficulties being overcome, but it is remarkable because it is a public work which has been built at much greater speed than was promised and with less money than it was stated would be required. The city is doing the building with its own workmen and with its own engineers, one small contract excepted.

Only in the arid West does one come to a full realization of the value of a drop of water. Here it becomes the pearl without price. In a land where the rains fall with the first days of November

TWO CATERPILLAR TRACTION ENGINES COUPLED TOGETHER AND HAULING ONE OF THE BIG POWER-SHOVELS INTO THE DESERT, WHERE IT IS TO BE PLACED AT TRENCH EXCAVATION

A STEAM SHOVEL AT WORK DIGGING THE CONDUIT THROUGH THE DESERT

and cease with the coming of April, not to descend again until the approach of another winter, the truth of this saying is appreciated. Los Angeles lies in the heart of such a land, where through the long summer growing things usually mark moisture artificially applied.

Five years ago, when the city stood face to face with the grave problem of a steadily decreasing water supply and a rapidly increasing population, Owens Valley, the cleft in the Sierra from which the waters are to be taken, was almost unknown. Today even the children of the public schools have familiarized the location and characteristics.

The valley is a narrow one. Seven miles will span it at almost any point. To the eastward are the brown Inyos, to the westward the white Sierra. This latter range of mountains forms the roof-shed of the United States. Mount Whitney, snow-clad monarch of them all, rises to a height of 14,502 feet. Twenty-three other peaks exceed 13,500 feet in elevation. Along the Sierra the snows lie deep throughout the year. From the base 35 streams debouch and pour into Owens River from a drainage of 2,800 square miles.

Since the time when the land was new this river has spent its volume in alkaline Owens Lake, which has an approximate area of 75 square miles. Without an outlet, the very high evaporation of 90 inches each year has kept the lake at about the present size. Some water from the river has been used for irrigation in the valley, but by far the larger part has done service for no man.

To insure a water free from alkali, Los Angeles has gone 35 miles above the mouth of the river to build the intake of the aqueduct, and the supply that the city will use in the future will be of almost half the mineral content that its citizens are now drinking. There are a few scattering settlements in the valley, but the rugged mountain chain which yearly sends down its floods offers scant encouragement to the settler. Moreover, the government has included the territory within a forest reserve, so that freedom from human contamination, apparently, is forever preserved.

SECURING THE LAND RIGHTS

The ranches which carried water rights were purchased for cash in hand. Land was cheap then in Owens Valley. Los Angeles bought 120 square miles for a little over $1,000,000, and did this so quietly by the use of water-works funds that speculators who follow a city in its enterprises like dust follows in the rear of an army were unaware of their opportunity until too late. Compare the expenditure for this item with the millions which New York city has paid to insure the pureness of its new supply.

So much for the prize for which Los Angeles paid little more than a million, and for which it is now expending $23,000,000 to bring within the city limits! Now to follow the sinuous course of aqueduct building, marked today by hundreds of tents and unpainted buildings strung out along the desert, or perched high on mountain sides, or hidden away in canyons.

The big water-course is designed to deliver a daily supply of 260,000,000 gallons to the two storage reservoirs at its lower end.

The first 22 miles, from the intake to the toe of the Alabama foothills, is in canal 50 feet wide and 10 feet deep, uncemented and at a slightly higher elevation than the river. The excavation is here being done by three electric dredges working night and day, and with 8 miles completed April 1, 1910.

At the Alabama foothills we strike into the mountain side, where a concrete ditch 18 feet wide and 15 feet deep is being constructed. This will receive the flow of half a dozen good-sized mountain streams in addition to that of the river, and will carry the water, at an elevation of 200 feet above the surface of Owens Lake, a distance of 38 miles to the Haiwee reservoir.

THE STORE-HOUSE OF THE WATERS

The Haiwee basin is the old course of the Owens River before the stream was

WHERE ROADS ARE NOT PRACTICAL, LOG RAILWAYS AND AERIAL TRAMS CARRY MEN AND MATERIALS TO THE POINT WHERE THE ENGINEERS HAVE LAID OUT THE COURSE OF THE AQUEDUCT

ONE OF THE MANY SMALL AQUEDUCT SUPPLY STATIONS IN THE HEART OF THE MOJAVE DESERT

J. B. Lippincott, Assistant Chief Engineer (with book); Hon. Fred Eaton (center), father of the Owens River project; William Mulholland (side), Chief Engineer

dammed into Owens Lake, and at a time when Mother Nature was making over the Western Hemisphere. When the hydraulic-filled dam is completed, the reservoir will have an area of 15 square miles, and will serve for storage, regulation, and clarification of the summer floods. Once full, if its supply were to be cut off entirely the storage capacity is sufficient for the needs of Los Angeles for more than three years.

From the Haiwee reservoir the water will be carried southward in a closed concrete conduit for a distance of 125 miles, following, as a rule, the contour of the country through which it passes. Sometimes the snaky thing of dirty white will lie along the surface of the desert; at other times it will rest in niches cut in rocky mountain walls; canyons it will descend on one side, then ascend the other as a large cylindrical metal shell nearly an inch in thickness; mountains which forbid ascent will be burrowed. When at length the northern base of the Coast Range has been reached the waters will be given rest in the Fairmont reservoir, but only temporarily.

HOW THE WATER WILL BE RELAYED

From the bottom of the basin, which is one for regulation, the water will pass 26,860 feet through a tunnel under the Coast Range to come out on the edge of San Francisquito canyon; thence for 11 miles through conduit and tunnel to be shot down 800 feet upon the restless wheels of two large hydro-electric plants; thence for 7 miles and another sheer descent of 700 feet to develop more electric power; then on again 16 miles to a third power plant, finally to find freedom in the San Fernando reservoirs.

These two basins perched on the rim of the San Fernando Valley will look down 1,000 feet upon Los Angeles, 20 miles away, and a score of other towns and cities of the Pacific coastal plain. No pumping is anywhere necessary. The only expense will be that of maintenance, which should be small because of the enduring character of the materials em-

BUILDING THE GRAY RIDGE ROAD IN THE JAWBONE DIVISION

Eight miles were cut out of solid rock. The background gives an idea of the boldness and barrenness of the mountains in the Jawbone Division of the aqueduct

ployed in the construction. From the intake, at an elevation of 3,800 feet, the water of its own gravity will flow with gentle velocity, excepting at points where power is developed, to the impounding basins at the lower end, and will there be drawn off as needed for irrigation and domestic use.

The size and the shape of the conduit south from the Haiwee reservoir vary greatly. Both are determined by the character of the country and the soil formation. The average size of the excavation now being made is 12 feet wide and 10 feet deep.

With the exception of the 22 miles of unlined canal and the 38 miles of lined conduit which empties into the Haiwee reservoir, the aqueduct is being covered. The lining of concrete for the conduit ranges from 8 to 12 inches. The concrete slabs moulded into a covering have a thickness of 6 inches and are reinforced with steel.

There are 22 miles of canal, 43 miles of tunnels, 15 miles of steel siphons and concrete flumes, and 137 miles of concrete-covered conduit, with 13 miles of the remaining distance made up by reservoir distance. This makes a total of 230 miles from the point of intake to the lower outlet. Thence the water required for domestic consumption will be carried 20 miles in a riveted steel supply main, which will empty into the reservoirs of the city's present distribution system.

This is the Los Angeles Aqueduct. The major portion of the most difficult and expensive part of the work is finished. In point of difficulty 68 per cent of the aqueduct and 46 per cent in distance is completed.

THE GROUNDWORK OF THE PROJECT

Let us go back five years and with the first party of engineers examine the bare expanse across which they were expected to search out the cheapest and most feasible route. There was then a rambling trail that led out of Mojave on the Southern Pacific north to Keeler on the shores of Owens Lake and the terminal of the Carson and Colorado narrow gauge. The path was dug into the desert more than 40 years ago by the wheels of "Remi" Nadeau's 20-mule freighters, which carried the rich silver ore of the Sierra Gordo mine to the port of San Pedro at the rate of four cents a pound. Wind and sand and cloudburst in the mountains have changed it somewhat with the years, but Vasquez and his gentlemen of the road, were they alive today, could still pick out the points of vantage where they gave unwelcome greeting to travelers of the trail.

For four decades and until 1909 a stage coach, vestige of the days of '49, made tri-weekly journeys as the only method of communication and transportation between Mojave and Keeler, stopping at seven points for change of horses. These seven points mark as many waterholes. You will not find the precious fluid elsewhere along the path. Had you not the wherewithal to ride, and had the trace of wheels been blotted out, you could have still guided your steps by empty bottles. It is a dry land and brings thirst quickly.

At times even fuel with which to cook—and fuel was sage brush—became a rarity for these engineers. One party followed another until there were more than 200 men in the field. With laborious effort they marked their progress with a line of stakes set 50 feet apart, sometimes in places where a human foot had never trod nor cared to tread. They found little or no water, no fuel for the development of power, no railroads to carry materials, men, and subsistence, and for 100 miles within the zone of the aqueduct not even trails.

The $23,000,000 bond issue was voted June 13, 1907. Immediately the portion of the plans of these engineers that called not for aqueduct excavation, but for overcoming obstacles by which aqueduct construction might be accomplished, began to materialize.

A FEW OF THE DIFFICULTIES OVERCOME

They built 225 miles of road and trail, one notable example in the Jawbone Division being hewn for 8 miles in solid

IN THE SOUTH PORTAL OF THE ELIZABETH TUNNEL, WHICH IS NEARLY FIVE MILES LONG (26,860 FEET), AND PASSES UNDER THE COAST RANGE

Miners at work on the face with Leyner drills, in 13,000 feet

THE MUNICIPAL CEMENT MILL, WITH CLAY BEDS AND LIMESTONE QUARRIES, COSTING $750,000

rock at a total cost of more than $40,000. They laid 180 miles of water mains from springs far back in the mountains to the line of the aqueduct. These systems are four in number, and with reservoirs at high elevations insure a copious supply of pure water for domestic use and for the mixing of concrete. They staked the course of a standard gauge steam railroad 125 miles in length with the expectation that the city would construct, own, and operate the line. The Southern Pacific stepped in, however, and in return for the handling of the 1,000,000 tons of aqueduct freight took the transportation problem off the city's hands. The new road is completed today from Mojave to Owens Lake, and by fall will be in operation to the mouth of the Owens Valley. The railroad parallels the aqueduct as far as this is feasible.

Materials and supplies are stored in warehouses along the tracks and thence are trucked by mule-team freighters or caterpillar traction engines to the places where they are required. For long stretches the aqueduct lies at an elevation of 1,200 feet above the desert, and at points where road construction is not feasible aerial cables serve as carriers.

With the questions of water supply and transportation out of the way, there yet remained the problems of communication and of power for the mechanical equipment. The difficulty in the first instance was disposed of by the building of a copper wire telephone system from the headquarters in Los Angeles to the intake, 250 miles north. From the main line branches ramify into each of the 100 or more camps, so that the chief is always in touch with his engineers.

The energy of two mountain streams have been utilized to furnish power. Three hydro-electric power plants generating a total of 3,300 horse-power have been erected, and the electric fluid is carried over high-resistance transmission wires as far southward as Mojave. By this means the three dredges are driven, many of the power shovels, all the tunnel equipment, half a dozen machine shops, and a cement mill, not to mention the lighting of all the camps. The expense has amounted to one cent per horse-power per hour. To have employed steam at the high cost of fuel, not to consider the scarcity of water, would have cost ten times this amount.

The sandy waste that for centuries has felt only the light tread of the skulking coyote today crunches under the wheels of heavily laden lumber freighters, and canyons that had heard only the wailing cry of the mountain lion resound with the tattoo of hundreds of hammers. The sometime path of the aqueduct through the silent desert became a scene of transformation. Barns, warehouses, laborers' quarters, mess-halls, power-houses, and hospitals went up as if by magic. Where there was immediate need, white tents arose over night like mushrooms in a pasture after an April rain. Eight months saw 500 wooden structures erected and 600 temporary canvas shelters.

THE CITY MANUFACTURING ITS OWN MATERIAL

In the estimate of materials required, 1,200,000 barrels of cement was the principal item. Cement is a mixture of limestone and certain clays rightfully proportioned, burned, and ground to an impalpable powder. Mixed with sand and gravel and water, it forms a concrete that, after being allowed to set, has the hardness of rock.

Almost midway between the intake and the outlet of the big watercourse, and on the main line of the Southern Pacific Railroad, the city's engineers discovered excellent deposits for the manufacture of cement.

No city previous to this time had entered into the cement-making business, but Los Angeles, undeterred, purchased the lands and began the erection of a plant. Los Angeles today owns the village of Monolith, is the sole employer of the 250 laborers and skilled artisans dwelling therein with their families, and every 24 hours ships out along the aqueduct more than 1,000 barrels of cement. Even at this rate the mill cannot keep pace with the unprecedented speed of

PLACING THE FORMS, TO BE FOLLOWED BY THE POURING OF CONCRETE

BUILDING THE AQUEDUCT IN A NICHE CUT HIGH ALONG THE MOUNTAIN'S FACE
The steep pitch of the land is shown in upper half of photo

building, and recourse is also had to corporation mills.

In two localities within the aqueduct zone deposits of tufa or volcanic ash have been discovered, and grinding plants have been erected at both points. The product is mixed with the Monolith cement to form a mixture stronger but closely similar to the material used by the Romans in the construction of their aqueducts 2,000 years ago, and which are doing service to this day.

While this preliminary construction was in progress 18 months rolled around. In December, 1908, the Los Angeles Chamber of Commerce called upon the chief engineer to give a statement of how much of the aqueduct had been completed to that date.

Mr Mulholland met the committee of this body with some trepidation. It is human nature, whether in Maine or California, for taxpayers to demand results, and these immediately. "Well," he answered, "we have spent about $3,000,000 all told, I guess, and there is perhaps 900 feet of aqueduct built. Figuring all our expenditures, it has cost us about $3,300 per foot"—this defiantly. He waited for his words to sink in; then added, "But by this time next year I'll have 50 miles completed, and at a cost of under $30 per foot, if you'll let me alone."

"All right, Bill," said the chairman. (In Los Angeles, grown from a village to a metropolis in a decade, the residents still call each other by their first names.) "Go ahead; we're not mad about it."

THE RESULT OF CO-OPERATION AND CONFIDENCE

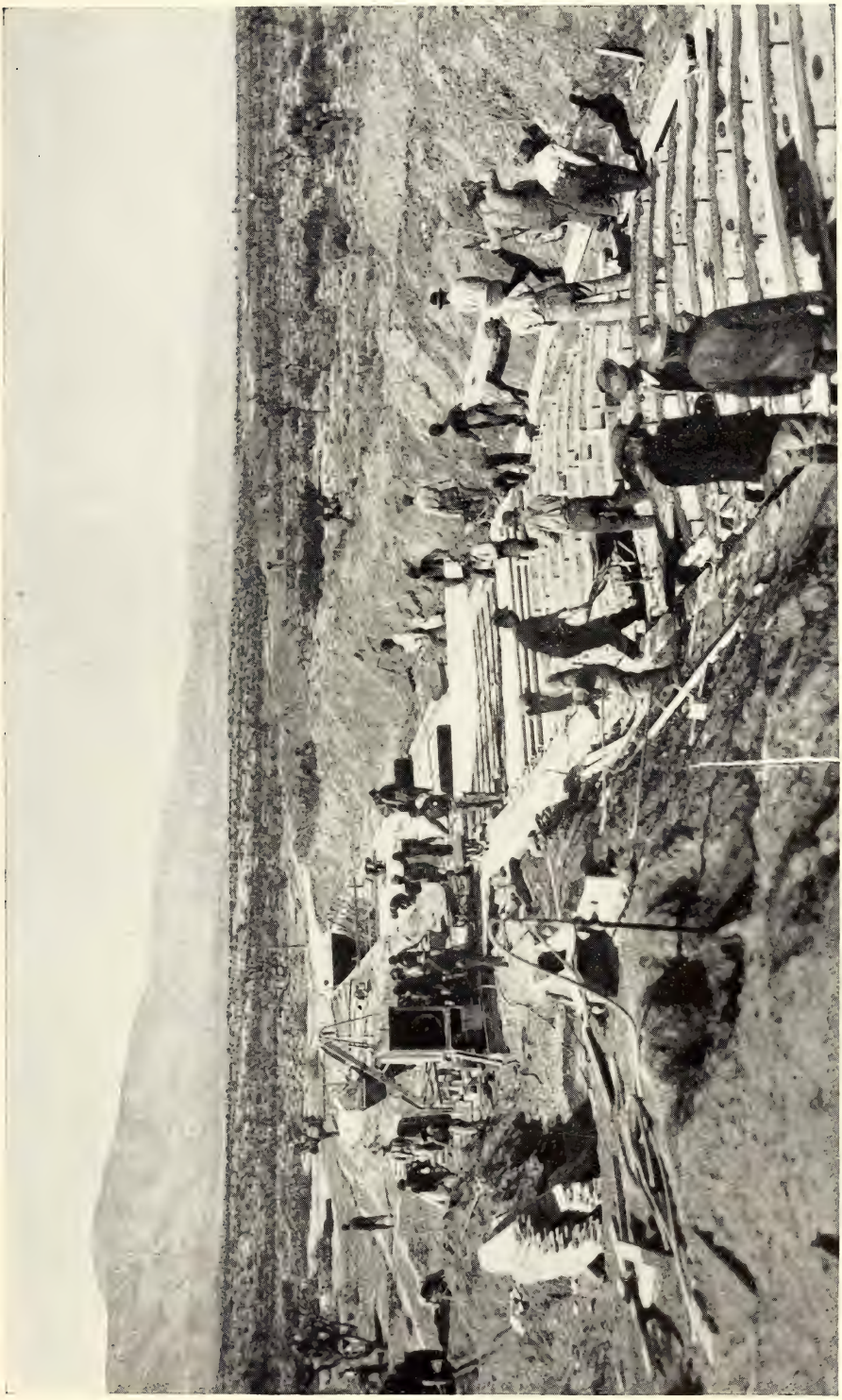
Herein is to be attributed no small part of the success of the undertaking. Mulholland has the confidence of the community. It believes in him implicitly, and he believes implicitly in the job and the men under him. "If Mulholland told these people he was building the aqueduct out of green cheese," said a newspaper reporter, "they'd not only believe but take oath that it was so."

The project is inseparably associated with the man and his life's work. He is now 54 years of age and is Irish by birth. At 20 he came to America. Two years later he landed in California with a fair education, a wonderfully retentive memory, ambition to improve himself, and $10 in his pocket as his capital. His first work was in digging artesian wells. Six months afterward he accepted a position as "zanjero," or ditch-cleaner, for the Los Angeles City Water Company. For three years he lived alone in a cabin far up in the Los Angeles River bottom. His days were passed in ditch-cleaning, his nights between sleep and study. Step by step he pulled himself upward. In 1882 he was made superintendent and chief engineer of the company. The impecunious policy of the corporation and an inability to keep pace with the growth of the city forced the municipality, in 1902, to take over the property.

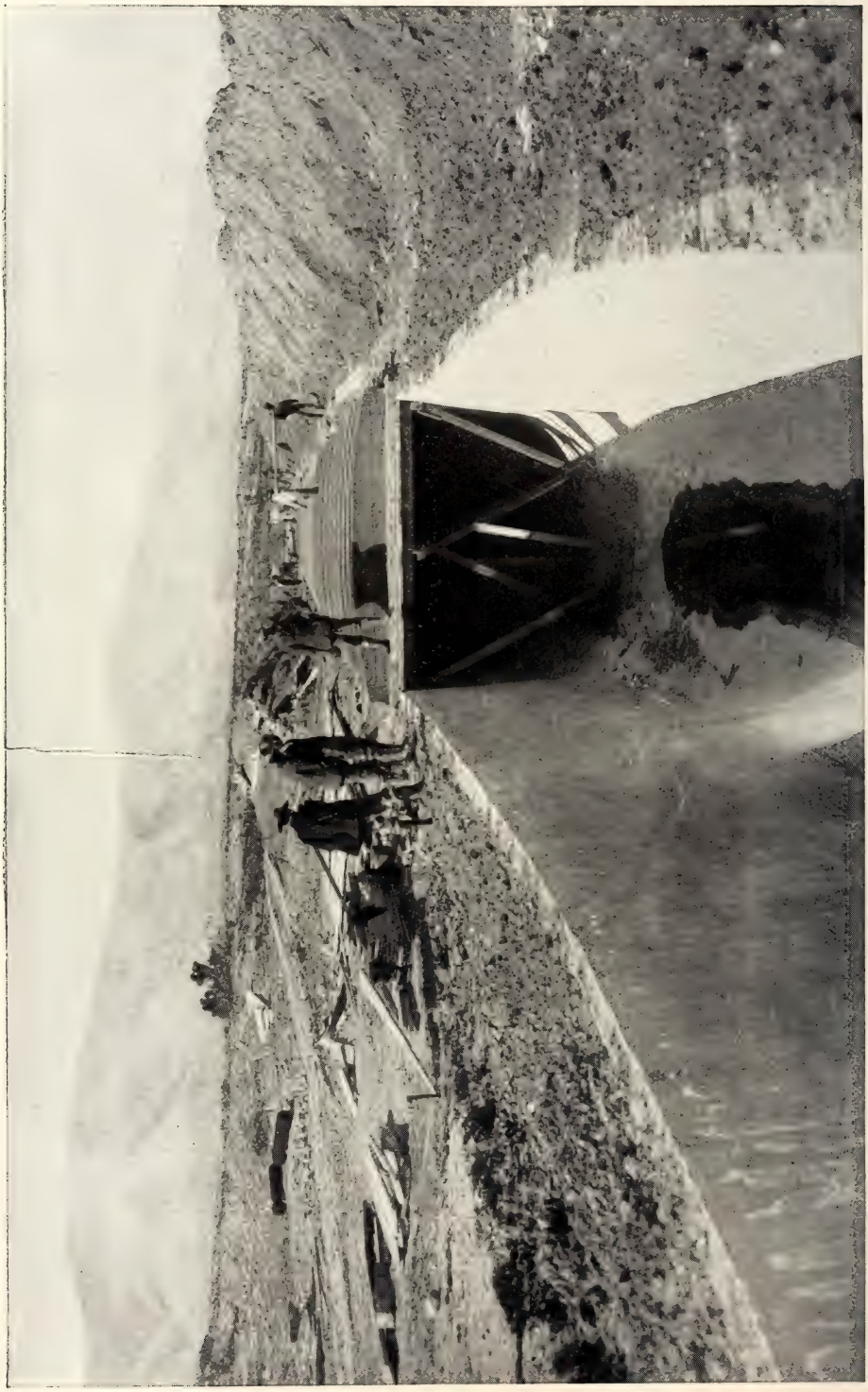
Mr Mulholland was retained in his position, and a non-political Board of Water Commissioners was placed in office. Under the supervision of Mr Mulholland and these men the enterprise prospered exceedingly. Today it is one of the three most successful water works in the United States.

No sooner was the water department upon a firm basis than Mr Mulholland set about to seek a source of supply larger than that of the Los Angeles River. Mr Fred Eaton, at one time superintendent of the City Water Company and later city engineer, then mayor of Los Angeles, had lived in the Owens Valley for 13 years. He felt confident that in this cleft in the Sierra lay the city's only hope. Mr Eaton prevailed upon Mr Mulholland to visit the valley with him, and he returned with the conviction that Mr Eaton had found what he himself had sought without avail. Neither the great distance nor the seemingly insurmountable obstacles could frighten him. He knew only that Los Angeles must have water to continue her existence as a city, and that the water must come from the Owens Valley, 250 miles in a straight line to the northward.

The Water Board purchased or took options on $1,000,000 worth of land and water rights solely upon his recommendation, the money being advanced from



PUTTING ON THE COVER OF THE AQUEDUCT IN THE MOJAVE DESERT



SHOWING OPEN CONDUIT AND THE COVER IN PLACE

the revenues of the water department, of which the board has the right of expenditure.

FINANCING THE PROPOSITION

In 1905 the people voted $1,500,000 in bonds to pay for these properties and carry on the preliminary engineering investigations. When his plans and estimates had been approved by a board of consulting engineers of national reputation, they voted $23,000,000 more to complete the project. This was the extent to which the people could bond themselves under their charter from the State, and was a tax of $88 upon every man, woman, and child within the corporate limits. They knew also that they would be called upon to vote upwards of $6,500,000 more bonds for the electric-power development as soon as the city, by its growth in taxable property, could legally do so.

Here, certainly, was not only an enduring faith in themselves, but a blind trustfulness in the man who had told them what they must have and how they could get it.

The faith was built largely upon the successful operation of the present water system, the known honesty of the public servants identified with the plant, and the absolute freedom from all politics which has been maintained in the water department since the city began the purveying of its water.

The confidence that has been given Mr Mulholland and his chief assistant, Mr J. B. Lippincott, formerly United States Government Reclamation Engineer for the Pacific Coast, they have passed on to the men whom they have assembled about them in the work.

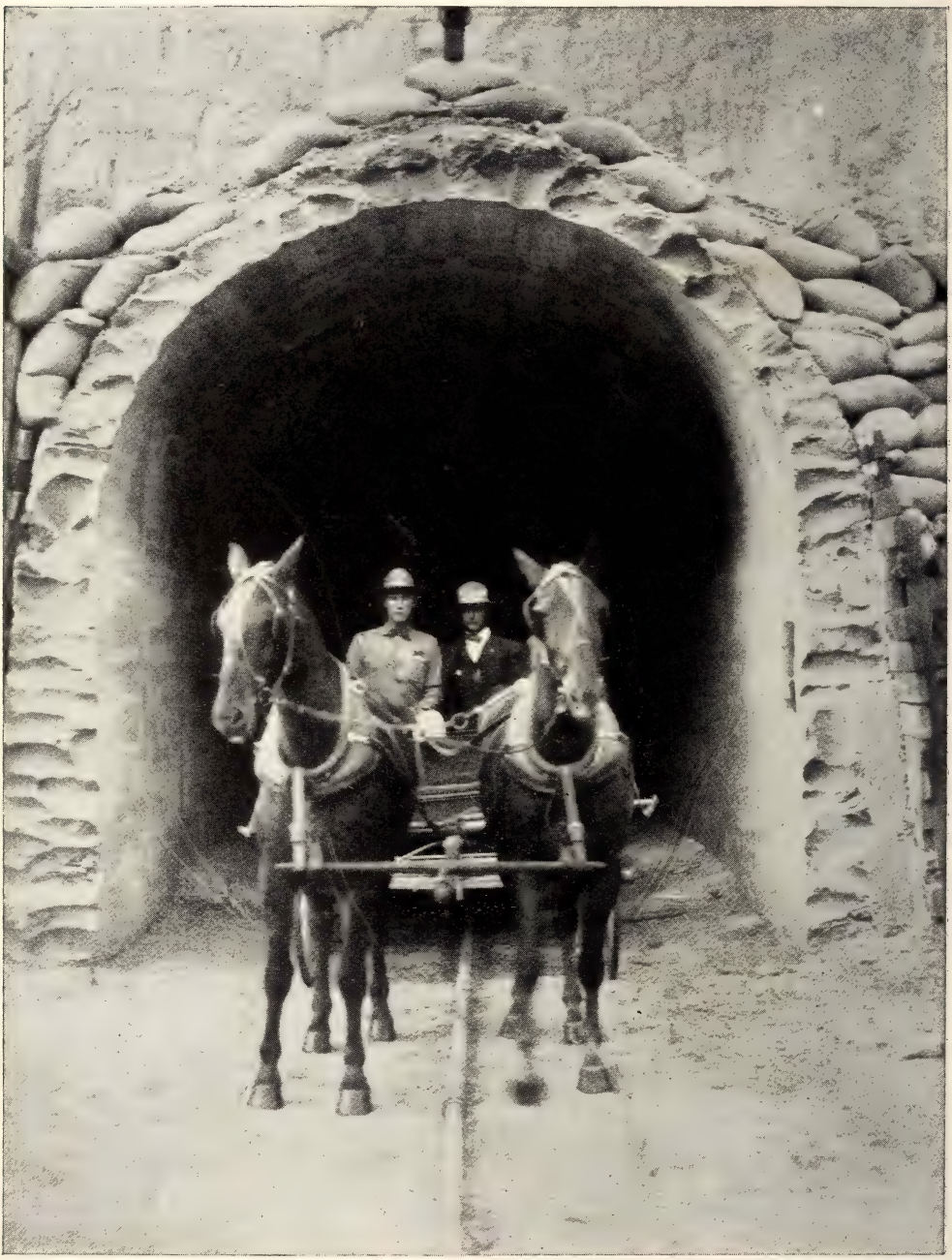
By the time the preliminary preparations for construction had been completed an efficient organization had been developed. The line of the aqueduct was apportioned into 11 divisions, the length ranging from 6 to 23 miles, depending upon the character of the construction. An assistant engineer was placed in charge of each of these and given large latitude in the management of its affairs.

THE QUESTION OF THE CONTRACTS

When the time came to determine whether the work should be done by contractors or under the direct supervision of the city, the aqueduct engineering force stood ready for the latter upon 30 days' notice. Mr Mulholland was anxious that the city should do its own work. He contended that this was what he and his assistants had been employed to do, but the Board of Public Works, which has the expenditure of bond moneys, was undecided.

Bids for the construction of the Jawbone Division, comprising 23 miles of the most difficult excavation, were advertised. The proposals ranged from 50 to 100 per cent higher than the estimates which had been prepared by the city's engineers. The board told Mr Mulholland to roll up his sleeves and pitch in. Three weeks after the command was given they were opening the first tunnel portals. This was in November, 1908. Just 12 months later a little over 50 miles of conduit, tunnel, and canal had been dug. In the Jawbone Division the cost was in many instances 50 per cent less than the figure demanded by contractors, and the entire 50 miles required an expenditure of between 10 and 12 per cent less than city engineers had estimated.

At the time the bonds were voted the promise was made that the enterprise would be finished in the summer of 1913. April 1 the Aqueduct Bureau, basing its estimates upon the work already accomplished and the daily rate of progress, stated emphatically that Owens River water would be delivered in Los Angeles by May 1, 1912, and at a cost less than the $23,000,000 which the people had provided. How much less they did not pretend to say, but there were intimations that it would be a round $2,000,000. However, June 1 the flurry in the money market caused the city's New York bankers temporarily to stop taking aqueduct bonds until some time in the fall. Construction was therefore immediately scaled to meet the new conditions, as the bureau at the time had little more than $800,000 on hand. A popular subscrip-



ONE OF THE AQUEDUCT TUNNELS

THE AQUEDUCT SPANS SMALL DESERT WASHES BY RECTANGULAR CONCRETE CULVERTS

tion for aqueduct bonds will be opened during July for the purpose of adding to this fund.

The loss of time, and, what is of greater hurt, the partial destruction of an organization wonderful in its efficiency, will extend the time of completion somewhat beyond May, 1912. Despite the temporary delay, due entirely to the unforeseen financial conditions, there is every reason to believe that the task will be accomplished well within the original time limit.

Six months after the opening of the Jawbone Division, the Board of Public Works let a small contract of 10 miles of easy conduit and tunnel section, because the board desired to be able to compare private and municipal efficiency, the result to guide them in the building of the remaining aqueduct mileage. The city, with the exception of this one contract, is doing all its own work.

Basing the cost upon contractors' bids for the completion of the Jawbone Division and the extras made necessary on the single contract, the aqueduct could not have been completed under $40,000,000. This statement is based upon the careful figures of the aqueduct's cost-keeping department.

Throughout the country there are an overwhelming number of illustrations to show that where a municipality undertakes its own public work, the cost and period of construction range from one to one and a half times more than under private contract.

THE CITY DIVIDES THE PROFITS WITH THE WORKMEN

What, then, are the reasons for the unexampled speed and low costs? First, undoubtedly, is the complete preparedness provided before any excavation was attempted. Secondly, the efficiency of the men and the organization of which they are a part. This is a public work without any politics. All employees are American. There is no contract labor employed. There are no men on the pay-rolls who have outlived their usefulness, or have been failures in life and have found a berth because of friendship at the city hall. Youth and virility fill the ranks of the 5,000. Every man in a position above that of day laborer received his certification from the City Civil Service Commission. He holds his place provided he is competent for the duties assigned him and not othewise. He climbs upward and is given preference as he shows himself capable.

Every one works for records. These are published for each 10-day period and sent broadcast by the cost-keeping bureau, and thus the spirit of rivalry is fostered and intensified. When a camp once gains the pennant for good and rapid work it strives with all its might to retain the emblem.

The city further divides with the men the profits which result to the municipality from unusual endeavor on the part of its employees. A careful determination is made of how much tunnel can be bored in a certain character of rock or soil by a crew in 10 days, or the average distance that should be made by a power shovel or a concrete gang in the same interval. Wherever the set distance is exceeded, every 10 days the city pays a bonus to each man for every extra foot accomplished. Under this system the workmen themselves drive out the laggards and the drones. Drones and laggards retard progress and cut down the bonus. That the city's policy is a paying one is shown by the fact that all American records for tunnel boring have been repeatedly broken, as well as those for other forms of excavation and cement working.

The engineers have not participated in the money awards. When the opening of the aqueduct was placed one year ahead of time, an assistant engineer complained to the board: "This is a great thing for the under dog, but where does the engineer come in? His only reward is to work himself out of a job as quickly as possible, while the men under him reap the benefit in increased wages."

"We hadn't thought of that," admitted General Chaffee, who is at the head of the Aqueduct Advisory Board. "We'll look into it." Two weeks later a notice was posted of a substantial increase in

BUILDING AN INVERTED SIPHON ACROSS WHITNEY CANYON TO CARRY THE WATER DOWN ONE SIDE AND UP THE OTHER (SEE PAGE 574)

ANOTHER VIEW OF AN INVERTED SIPHON: IT IS BUILT OF CONCRETE HEAVILY REINFORCED WITH STEEL (SEE PAGE 576)

UNDERCUTTING FACE OF BANK: THE DREDGE IS DRIVEN BY ELECTRICITY

salaries for assistant engineers and superintendents. A day laborer who has a complaint receives the same courteous treatment and there is the same willingness on the part of the board to investigate.

June 1, 1910, 99.9 miles of aqueduct had been excavated. Of this, 36 miles was tunnel, bored for the most part through solid rock at the average rate of almost two miles per month. Think of it! For the last ten days of May the total distance in tunnel, conduit, and canal excavated was 16,983 feet, or at the rate of very close to *ten miles per month.*

THE SUPPLY AND THE DEMAND

Necessity is a relentless taskmaster, and it was dire need which drove Los Angeles to its conquest of the desert. However, from a commercial viewpoint, the financial returns from this source are small indeed compared with the revenues which must accrue from the sales of water for irrigation and from the disposal of electric energy.

The city paid $2,500,000 in round numbers for its present supply and distribution system. In eight years the actual property value, exclusive of all water rights in the Los Angeles River bottom, has been increased to $6,500,000. All this and much more has been accomplished from the sale of water for domestic use. The city's daily consumption now averages 35,000,000 gallons. With other towns which will draw on the new supply, in 1925 it is estimated 110,000,000 gallons daily will be required for domestic consumption at a rate close to the present one of nine and two-thirds per 1,000 gallons.

The new water supply at its full capacity can deliver 260,000,000 gallons every 24 hours into the San Fernando reservoirs. These, conserving the golden flood during the time of winter rains, when there is least demand, will assure a withdrawal of more than 300,000,000 gallons daily during the five months of the hot, dry summer season. It will thus be seen that much more than half of the aqueduct's capacity can be devoted to irrigation for a very long term of years.

In the San Fernando Valley and spreading out directly beneath the two great reservoirs, government reports show that there are from 60,000 to 75,000 acres of fertile lands which can be made highly productive if water can be brought to them. In the San Gabriel, the Cahuenga, and other valleys, this area is increased to more than 200,000 acres—an area furnishing a market for a larger amount of water than the city will have for sale for irrigation purposes. This several hundred square miles of territory, which for years has been included in a few great ranches, each comprising thousands of acres, is being broken up into small ranches averaging not more than 40 acres, in anticipation of the coming of waters.

These ranches five years ago could have been purchased at from $10 to $40 an acre, which is the average value of lands having no prospect of water. Today they are being sold in the San Fernando Valley at prices ranging from $60 to $200 an acre. Under irrigation and with citrus orchards in bearing, they will command prices ranging from $1,000 to $1,500 an acre, which in the citrus fruit belt is considered an average price.

The increase in the value of these lands has been brought about solely through the city's construction of the aqueduct. As yet Los Angeles has made nothing public concerning any plans it may have for the benefited area to pay a share in the cost of the aqueduct, but undoubtedly some means will be devised by which the territory will pay a just proportion, exclusive of the annual rental which will be charged for the water consumed. The lands, once brought under cultivation, will increase the assessed valuation enormously.

The discussion of electric power possibilities has been left for the last for the reason that it deals with revenues and possibilities of civic greatness which are larger than those of either domestic use or irrigation.

A SCENE IN THE HIGH SIERRA, WHERE THE WATER COMES FROM

A CITRUS ORCHARD IN THE SAN GABRIEL VALLEY, A FEW MILES FROM LOS ANGELES

This photograph was awarded the grand prize in the photographer's contest held by the Chamber of Commerce. Photograph taken January, 1910, by Geo. R. King, Pasadena, Cal.

SPLENDID POSSIBILITIES FOR ELECTRICAL DEVELOPMENT

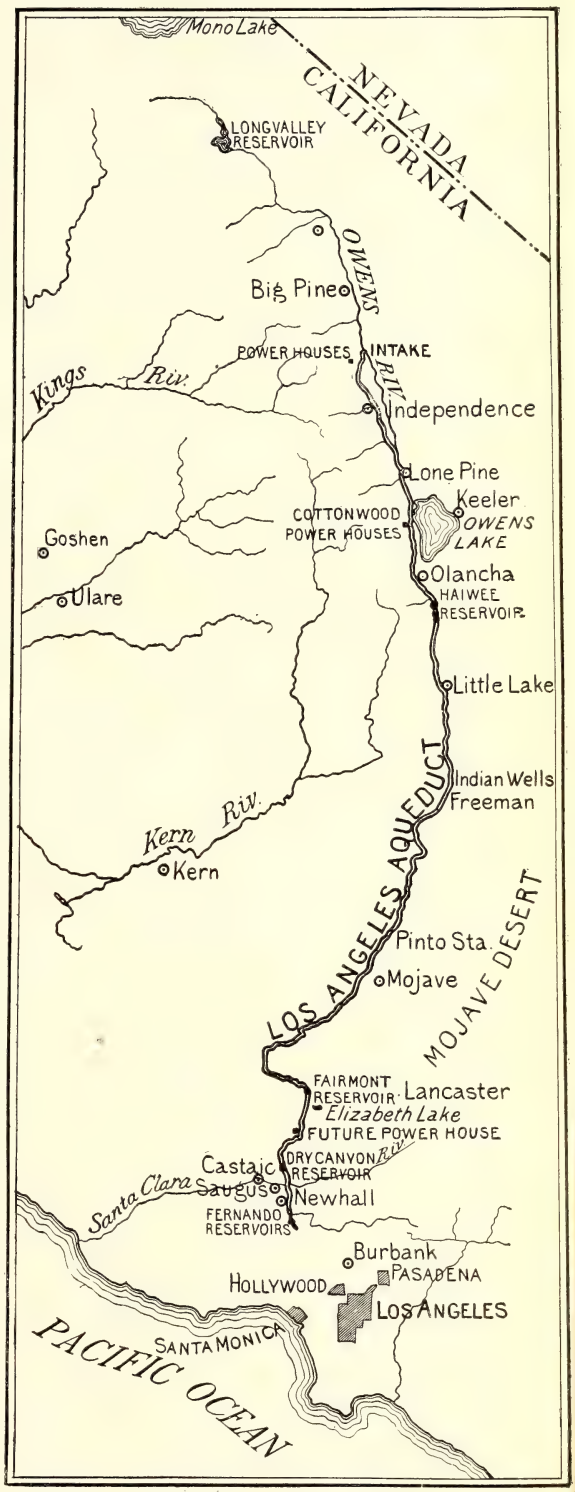
The total output of electric energy, in a report made March 4, 1910, by three of the foremost electrical engineers in the United States, is placed at 120,000 horse-power peak load. Of this amount, 80,000 horse-power can be developed within 50 miles of Los Angeles. April 19, 1910, a bond issue of $3,500,000 was voted by a large majority for the purpose of partially developing this large source of income, estimated at 49,000 horse-power. The hydro-electric plants are to be constructed and ready for operation at the same time that the aqueduct is opened to the flow of the Owens River.

The present consumption of power for all purposes in the entire county of Los Angeles is estimated as not exceeding 80,000 horse-power, of which 55,000 horse-power is consumed within Los Angeles city. It will require a long series of years to find a market for such a large amount of power as the city has at its back, and this is recognized by the development of only a fraction of the possible output just at this time.

Mr E. F. Scattergood, the aqueduct's chief electrical engineer, prepared estimates in 1906 for the development of 37,000 horse-power at a total cost of $4,490,000, the power to be delivered at the city's gates. With the sale of power figured at the low wholesale rate of eight-tenths cents per kilowatt hour, on a 50 per cent load basis, and accounting for all costs of operation, maintenance, interest on bonds, sinking fund, and depreciation of plant, he placed the net annual revenue at $1,406,000.

Mr Mulholland, in a public utterance on this subject, said: "I believe that the people have in the possible power development from the aqueduct an investment which 20 years hence will turn back into the city treasury the entire $24,500,000 provided for the construction of the aqueduct, with interest." His declaration is borne out by the hydraulic and electrical engineers who have been called upon to examine the plans and estimates.

Naturally a part of the surplus power will be taken through the growth of



manufacturing industry in Los Angeles, which has been phenomenal during the past decade. In 1900 the government industrial experts placed the city's manufacturing output at $5,000,000, and in 1905 at $30,000,000. This year Mr C. C. White, of the Census Bureau, in his preliminary investigations, places the total at $75,000,000.

With a cheap and abundant power such as the city will be able to offer, a constantly enlarging market must follow. Two hundred miles south of Los Angeles lies the Imperial Valley. Here for three years experiments in cotton-growing have been carried on. Last year's crop proved the industry a success, with a grade of cotton of a very superior quality. There were 1,000 acres under cultivation then; this spring 30,000 acres were set out to cotton plants. It will be remarkable if this new industry does not bring to Los Angeles likewise a new field for manufacturing. This is only one of the possible means of power disposal at which Los Angeles' commercial bodies are casting longing eyes.

For her own needs and for Pasadena and other cities and towns in the vicinity, electricity will be needed for street lighting, and in the construction of the municipal harbor at San Pedro another field awaits development of the magic juice.

These are lean years for the second metropolis of the Pacific Coast. She is straining every nerve and conserving every energy to meet the demands which her enterprise now makes upon her. With the spirit of the West, she has set out to accomplish, and, with the determination of the West, ultimately she will achieve. But, whatever the outcome and whatever the reward, certainly no municipality has ever waged a battle so remarkable in all its phases as this city by the Western sea.

GUATEMALA, THE COUNTRY OF THE FUTURE

By Edine Frances Tisdel

THE interest of the world is at present centered on the Isthmus of Panama and the wonderful work in progress there, so that in general little attention is paid, except by those commercially interested, to the adjacent group of small independent republics occupying the intervening space from Panama northward to the border of Mexico. They are apt to be thought of as countries continually torn by internal strife, devastated by earthquakes, and ravaged by disease—in fact, a sort of tropical wilderness scarcely worthy of a visit.

Never was there greater mistake. The beauty of the cities, the rapid extension of railroads, the cultivation and enormous proceeds of a wonderfully rich and fertile soil, all convince us of the progress of a people living amidst a wealth of scenic beauty and a perfection of climate rarely equaled.

This is particularly true of Guatemala, the most northern of the group, which, under the long and peaceful administration of President Estrada Cabrera, has been rapidly forging ahead to take its place on an equal footing with other nations of the world.

Three days' delightful sail from New Orleans to Puérto Barrios on one of the fine ships of the United Fruit Company brings us to these sun-kissed shores, where stately palms, stirred by perfume-laden breezes, wave in greeting.

The steady increase of American and German interests here is fast opening for our benefit one of the loveliest countries in the world, and the building of railroads is placing within easy reach the enjoyment of its natural beauties.

THE SUCCESS OF AMERICAN INDUSTRIES

All of the railroads are owned by an American syndicate and are absolutely under American control. From Puérto Barrios, on the Caribbean, the Northern road runs a distance of 224 miles up to the city of Guatemala, the capital. From here starts the Guatemala Central road, extending a distance of 74 miles to the port of San José, on the Pacific. The Guatemala Central Railroad has in all 216 miles of road throughout the country, and now in course of construction is a branch line 38 miles in length, to run from the city of Rétalhuleu to Ayutla, on the border of Mexico, to connect directly with the Pan-American road there. In a few months it will be possible to travel by railway from New York city to the capital of Guatemala.

This country was for centuries the home of the Maya-Quiché Indians, whose history reads like a romance. Cortez, however, after the conquest of Mexico, desiring to extend his power over the country farther south, in 1522 sent an invading army under the command of Pédro de Alvarado to subjugate this powerful race.

Leaving Mexico with some 300 Spaniards and a great number of Mexican Indians, Alvarado fought his way into Guatemala, overcoming all who opposed him, and finally, on July 25, 1524, founded the first Spanish capital under the name of Santiago de los Caballeros (Saint James of the Cavaliers). And so it happened that, in a beautiful valley at the foot of two great volcanoes, "Agua" and "Fuego" (meaning water and fire), was firmly established the Spanish rule which was to last for nearly three centuries—that is, until September 15, 1821, when Guatemala became an independent republic.

This first Spanish city was, however, 20 years later, almost completely wiped out of existence by a great flood of water which poured down upon it from Agua. There has been much controversy among scientists as to the origin of this flood. Some claim it to have been the result of a cloudburst, others that it came from the crater of the supposedly extinct volcano. The former supposition seems to be the most plausible, as research has so far failed to discover traces of a considerable body of water ever having existed in the crater.

The few survivors fled down the valley and at a distance of three miles chose the site of a new city, and, in 1542, courageously founded a second capital, now known as Antigua. In time it grew to have a population of 100,000 inhabitants, and became a great center of learning, with many universities, monasteries, and over a hundred churches rich in works of art. Although many times threatened by earthquake shocks more or less severe, it flourished until July 29, 1773, when, without warning, in one minute the proud city was leveled to the ground.

THE RELOCATION OF GUATEMALA'S CAPITAL

Again the survivors of this second calamity sought refuge farther away from the threatening volcano, and, at a distance of 35 miles, finally settled in the beautiful valley of Las Vacas. Here, at an altitude of 5,000 feet above the sea, surrounded on all sides by soft green hills, behind which loom the imposing heads of three volcanoes, lies the city of Guatemala, the present capital, founded by the courageous survivors of one of the greatest calamities in the history of any land.

This typical city of Spanish America is a most interesting and charming place to visit. Coming directly from the land of sky-scrapers, the first impression of it, with its low white buildings, is particularly attractive. Here and there is a house tinted a bright pink or a vivid blue, thus varying the monotony of the dazzling white and lending a sort of holiday look, as though the houses had put on their best gown to welcome the stranger.

The climate is one of perpetual spring, the average temperature being about 70 degrees. The summer months bring the heavy rains.

Although in a land of earthquakes,

BELLS TAKEN FROM CRUMBLING TOWERS OF CHURCHES DESTROYED BY EARTHQUAKE

this city has suffered little from them, only experiencing slight shocks from time to time. During my entire six months' stay in this country I did not feel even a tremor, and I really think that my friends were rather disappointed when I returned and was unable to give thrilling accounts of one of nature's upheavals.

With a population of 100,000 inhabitants, the city is laid out on a splendid scale, with broad avenues, fine parks, and handsome buildings. It is one of the best-lighted cities in the world. Street cars, little mule cars, run from one end to the other, and already a concession has been granted to an American syndicate for the construction of an electric line.

In the center of the city is the Plaza de Armas, with its pretty park, where stands the handsome statue of Columbus. This plaza becomes the rendezvous of fashion three or four evenings of the week, when an exceptionally fine band plays. Here also each morning at 10 o'clock a company of the President's Guard of Honor parades. Most interesting scenes are also witnessed on the nights of any national holiday or church festival.

The Indians come in from the surrounding country early in the day and install themselves in picturesque groups, selling native sweets, cocoanut water, and beautiful fruits. As night comes on they build fires which illumine their dark faces and brilliant costumes. The trees are hung with gay lanterns and at one side is stretched a great canvas upon which a free moving-picture show is in progress.

The band plays, and between times is heard the rather weird music of the marimba. This native instrument has a peculiar charm and, in spite of a certain metallic sound, not unlike a xenophone, when played in the open air has very beautiful tones. Often in the dead of night one is awakened by the plaintive tones of one of these instruments as some dark-eyed senorita is being serenaded.

The Cathedral, which stands facing the plaza, with its two square towers, is a fine example of the churches of Spanish America. A curious but not unpleasing effect is obtained in the interior by the blue-and-white ceiling. All the churches of the city are rich in wood carvings, paintings, and antique altar silver saved from the ruins of Antigua.

Throughout the country wherever the churches have suffered from earthquakes and the crumbling towers are no longer strong enough to bear the weight of the heavy bells, these are hung out of doors under a pointed thatched roof held by bamboo poles, which adds greatly to the picturesqueness of the landscape.

The Téatro Colon, the national theater, is a building of which any city would be proud. It is copied from the Church of the Madeleine in Paris. It is generously subsidized by the government, and good operatic and dramatic companies come from Italy, Spain, and Mexico. Bull-fighting is, of course, the favorite amusement, and there is a good bull-ring.

To the west of the city stretches the broad avenue of La Réforma, a beautiful drive several miles in length, shaded by great trees and containing some fine statues, the two most important being those of Gen. Rufino Barrios and Gen. Garcia Granados. At the beginning of the driveway stands the artillery barracks, a rather imposing building, and at the opposite end is the National Museum.

At the other end of the city is the wide boulevard leading to the hippodrome or race-course. Here we come upon the beautiful Temple of Minerva. President Cabrera believes in education, and under his enthusiastic directions there is no little town but has its public school. To commemorate the education of the youth of the country, he has set aside one day each year—the last Sunday in October—as a popular festival, and all scholars and teachers take part in the celebration, which is known as the Feast of Minerva. In each town of any importance is now to be found one of these temples.

LANDING PASSENGERS AT THE PORT OF SAN JOSÉ, ON THE PACIFIC

HOW GUATEMALA IS GOVERNED

The government of Guatemala is republican, the president's term of office being for six years. The legislative power is vested in a national assembly, which consists of one house composed of a deputy for each 20,000 inhabitants. Beginning the first of March, the annual sessions are held, lasting two months.

I well remember on the day of the convening of Congress that I expressed a desire of attending, as in other countries, one of the sessions. Had I dropped a bomb in the midst of the group who overheard the remark I could scarcely have caused greater excitement. "Impossible! Unheard of! Women did not go to Congress," etc.

The rumor spread, however, that the American girl wished to go, and a few days later my father received a gracious note from Señor Ubico, President of the Senate, inviting us to be present on a certain evening, for the meetings are held at night. Nearly a hundred members were present and several important bills were passed, among them one granting the concession for the building of the international bridge over the Suchiate River on the border of Mexico. It was most interesting and I had the honor of being the first, and, as far as I know, as yet, the only woman who has ever been admitted within the Congress Hall of Guatemala.

I was fortunate enough, also, through the courtesy of President Cabrera, to be shown the Palace, another place a woman has never been admitted to. Soldiers were drawn up and presented arms as we entered the large court, and we were met by one of the generals, resplendent in gold lace, whom the President had detailed to escort us. The wide white marble stairway, the reception rooms, and banqueting hall would bear comparison with many in the royal homes of Europe.

It was here that, on March 11, 1909, President Cabrera entertained Rear Admiral Swinburn, then in command of the American Pacific squadron, and some 30 of his officers. Never have I seen such

Indian Servants in Native Costume. Domestics receive $3 per month in Guatemala City

Indian of San Lucas. Costume of red and white stripes, the people resembling animated sticks of peppermint candy.

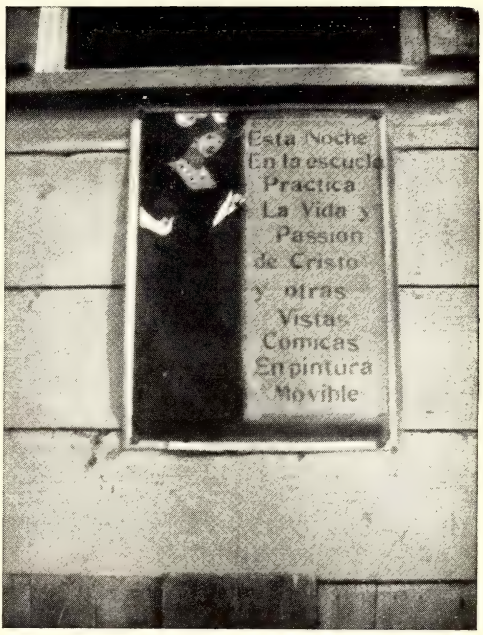
Indian Woman at Work in the Cotton Factory of Cantel

Little Indian Girl whose Name was Elvira Apolonia, known as "Apollinaris"

lavish expenditure as during the four days when our officers were this nation's guests. The city was gay with flags, flowers, and illuminations. The ball given by the city, and at which 800 guests sat down to supper in the beautiful "patio" of the Municipal Palace, was the most gorgeous affair of its kind I have attended.

These patios, or courts, are characteristic of the buildings, public or private, throughout the country. Here indeed a man's house is his castle.

The windows looking onto the streets are rarely opened, and for good reason. What in our country are known as sneak thieves here have an original way of obtaining their spoils. A long string with a fish-hook at the end is the instrument employed, and this, thrown in between the bars with a dexterity equal to the lasso-throwing of the cowboy, falls unerringly upon the chosen object, which in a twinkling is whisked away. Woe to the person who, leaving his things scattered around, goes out of the room without closing the window.



MOVING PICTURE POSTER ADVERTISEMENT SEEN IN CARIB VILLAGE

THE SELF-APPOINTED REGULATORS OF THE PUBLIC HEALTH

"The National Health Department," as it is amusingly nicknamed, is also most original. Sopolotes, or buzzards, are the scavengers of the land, keeping country and city scrupulously clean. One soon becomes accustomed to the long rows of these solemn but ungainly birds patiently waiting to pounce upon any morsel thrown out. Soap is their favorite dainty, and, as they are great thieves, it is impossible to keep a piece of this particular article unless well hidden.

Living is cheap here and housekeeping not difficult, particularly if one knows a little Spanish. The markets, besides being attractive and picturesque, are excellent. There is no fixed price for anything, and one soon learns to offer just half of what is asked. Then naturally follows more bargaining, and one finally gets the goods for at least two-thirds less than the original price. The servants are mostly Indians and are exceptionally good. They learn quickly, and with a little patience can soon be converted into model domestics. Their wages are about 50 pésos, or some $3 gold, a month.

The signs over the shops are sometimes puzzling and often amusing. I remember one in particular, which translated reads, "Milk from the cow's foot." It meant that the cow would be brought to the door and milked before one's eyes. Whether this improved the quality of the milk I was never able to determine.

The most original sign seen in Guatemala was a poster advertisement of a moving-picture show. This was on the wall of a native school-house in the Carib village at Livingston. It read:

> "Tonight, in the Practical School, the Life and Passion of Christ and *other comic* moving pictures."

THE ANCIENT CAPITAL OF ANTIGUA

In strange contrast to the modern city of Guatemala is the old ruined one of

TYPICAL STREET SCENE IN THE CARIB VILLAGE AT LIVINGSTON

In which the poster shown in the preceding picture was seen

Antigua, which I have mentioned, and which to those remaining only a short time in the country is the most important place to visit. It is preferable to ride, although one can drive in old-fashioned canvas-covered diligences. The earlier the start after sunrise the better, for the road as far as the Indian town of Mixco presents a most attractive scene, as hundreds of Indians are jogging into the city heavily laden with great loads of earthen pottery, fresh fruits, and vegetables for the market. Mixco is picturesquely situated, nestling at the foot of the mountains and commanding an extended view of the great Guatemala Valley, with the city almost at one's feet, and in the distance the sparkling blue waters of lovely Lake Amatitlan.

Leaving the highroad one turns into a narrow defile, and up and down hill follows an old Indian trail, sometimes completely shut in, again widening with glimpses of the mountains as range after range rises to the imposing heads of three great volcanoes—Agua, Fuego, and Acatenango.

I do not know of any place I have visited, not even Pompeii, which made such a deep impression upon me as this city of the past.

Nestled in a broad, fertile valley, the climate of which is unsurpassed, nothing can exceed it in solemn grandeur. Watched over by the giant Agua, which rises in one magnificent unbroken sweep to a height of over 13,000 feet, street after street stretches dazzlingly white in the brilliant sunshine. Not a sound breaks the silence which hangs like a pall over the place, and even the modern town of some 30,000 inhabitants seems dead, and a strange hush lies over all.

The quaint little pink hotel, with its flower-filled patio, the air heavy with the scent of roses, orange blossoms, and starry-eyed jasmine, is in keeping with the atmosphere of romance which pervades the place.

Of half a hundred churches still standing, those of the Cathedral, San Francisco, and Récollecion are the most imposing. Of the first-named enormous edifice, 300 feet in length, only the outer walls, pierced by 50 windows, and a few graceful arches remain of what must have been a wonderfully beautiful building. The bright blue sky looks down on a tangled mass of trees and flowers, and here in the midst of this sad reminder of past grandeur lives an Indian family, the roof of their outdoor kitchen supported by wonderfully carved pillars of wood.

A woman was kneeling in front of a large stone slab upon which she was pounding wet corn preparatory to making "tortillas," the flat corn cakes which, with black beans, is the staple food of the country. We were invited to stop and watch the process, and boxes and a dilapidated chair or two were brought forth from some mysterious recess for our comfort.

HAPPY CHILDREN OF GUATEMALA

GUATEMALAN GIRLS DRESSED FOR FIESTA

The picturesque corner, with the Indian woman in her native costume kneeling in the light of a flickering wood fire; round-eyed, staring children of all ages; dogs, chickens, and pigs innumerable; the exquisitely carved pillars etched against the gray background of ruined walls, and the delicate branches of a cherry tree in full bloom, giving the harmonious touch of color—all combined to make a picture never to be forgotten. As the twilight fell dark figures glided silently by, balancing on their heads large flat baskets of fruits for the morrow's market, and seeking a resting-place beneath the dim arches, where here and there heaps of corn husks showed that at night this grim pile was not untenanted.

The ruins of San Francisco are also most impressive, and from the crumbling belfry is obtained a magnificent view of city and surrounding country.

The beautiful ruins of Récollecion are the property of a German-American priest, who reaps great benefit from his gardens and coffee plantation, which he cultivates during his leisure hours. It seemed rather incongruous to see fat black hogs contentedly rooting under the shadow of these historical walls, but this "padre" is nothing if not practical.

Not far from here is the estate of "Pastorès," where there is a large flour-mill, the only one of its kind in this part of the country.

Three miles from the city are the beautiful warm sulphur baths of Médina and Cubo, to reach which one passes through great sugar plantations on roads in perfect condition, shaded by trees which, meeting overhead, form a cool green archway as far as the eye can see. Further on is Cuidad Viéja, the site of the first capital. All that remains of historical interest are the two crumbling walls of what was at one time the palace of the conqueror.

MISCO INDIAN ON ROAD FROM GUATEMALA CITY TO ANTIGUA

SCENE IN THE "VIRGINIA" BANANA PLANTATION OF THE UNITED FRUIT COMPANY: GUATEMALA

The plantation covers 5,000 acres and ships 300,000 bunches of bananas each year (see page 600)

CARIB WOMEN OF LAKE ATITLAN

INDIAN BOYS IN SCHOOL, ON LAKE ATITLAN

There is a school-house in every village. The government is doing its best to give the Indians some education, but the indifference of the parents and the difficulty of finding competent teachers handicap the work exceedingly.

INDIANS AT LAKE ATITLAN (SEE PAGE 621)

All the garments worn by these Indians are of native manufacture. The looms on which the handkerchiefs and shawls are woven are just the same as those pictured in the aboriginal Mexican manuscripts

DEVELOPMENT OF THE EXPORT TRADE

There is a fascination about this valley impossible to describe, and a spell seems to be cast over all who come here. It is difficult to tear one's self away and return to the busy life of the outer world, which in this country, however, can be seen to the best advantage on the great banana, coffee, and sugar estates, or "fincas," as they are called.

Bananas are grown almost exclusively on the Atlantic side. The largest banana plantation of the country is that of "Virginia," owned by the United Fruit Company of Boston. It covers 5,000 acres of land and exports annually 300,000 bunches of bananas, the total export from all sections of Guatemala being 1,500,000 bunches. The output of the United Fruit Company's Guatemala, Panama, Colombia, Costa Rican, and Jamaica plantations exceeds 22,000,000 bunches of bananas a year. The company has some 70 ships of from 3,000 to 6,000 tons running to the United States and Europe.

Almost the entire Pacific slope is given over to the cultivation of sugar-cane and the raising of cattle.

The best coffee is grown in the highlands at an altitude of from 1,500 to 5,000 feet.

THE COUNTRY'S PRODUCTION OF SUGAR

From the city to the port of San José, on the Pacific, the Guatemala Central Railroad passes the largest of the sugar estates. San José is the seaside resort of the country during the months corresponding to our winter, and here one finds a good hotel, fine bathing (although the undercurrent is to be feared), and a splendid iron pier some thousand feet long. The landing of passengers here is amusing to the onlooker, but far from reassuring for the ones concerned, who dangle helplessly in midair in a sort of iron cage, as steamers cannot come up alongside of the pier, and a small boat has to be the means of transfer.

But to return to the sugar. Shortly after leaving Guatemala City, the road follows for 15 miles the borders of Lake Amatitlan, where the Indian women of the city take advantage of the boiling springs which abound all along this body of water for their laundry work. At the town of Palin one is greeted by an extremely picturesque scene, for the train is besieged by Indians in gay costumes balancing on their heads large flat baskets of gorgeous tropical fruits—"forbidden fruit," indeed, to the traveler until thoroughly acclimated. I have never eaten such luscious pineapples as are grown here, besides many wonderful and delicious tropical fruits of which we of the North know nothing.

Here we are directly on the opposite side of Agua from Antigua and a magnificent panorama lies before us—on the right the fertile slopes of the great volcano, and before us the smiling, sunlit plain stretching away 40 miles to the blue waters of the Pacific.

Concépcion is perhaps one of the most interesting of the many large plantations. It covers 155,000 acres and produces each year 10,000 tons of sugar, 20,000 bags of coffee, besides many hundred head of cattle and thousands of bushels of corn. It belongs to a German syndicate and is valued at 1,000,000 marks ($250,000), on which it pays 15 per cent.

All of these estates have miles of private railroad, and a continual stream of little cars piled high with sugar-cane run from the distant fields to the factory. The process of sugar-making is interesting to watch from the very beginning, when the juice is crushed out of the cane by giant machinery. The dry fiber is then used to stock the enormous furnaces over which seethe and bubble huge caldrons of syrup. Boiled down to a soft mass like caramel, it is poured into shallow vats to cool. The unrefined sugar, of a dark-brown color, is commonly used throughout the country. It is called "panela," and is molded into half-round cakes, of which two together make a ball, and is then curiously wrapped in corn husks.

The dwelling-houses on all the estates are invariably comfortable, with wide, shady porches and every modern improvement and convenience, at night being lighted by electricity.

THE PLAZA AT COBAN, GUATEMALA

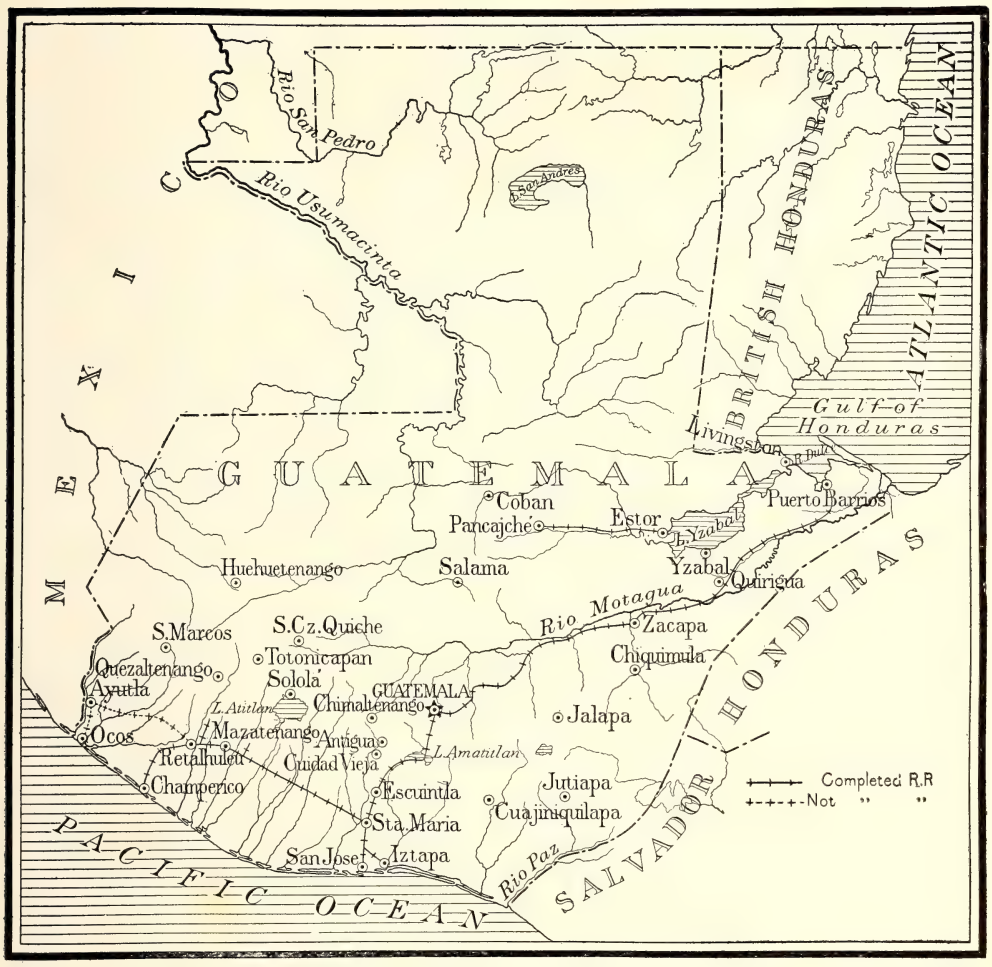
ONE OF THE MONOLITHS AT COBAN

Old Palace of the Viceroys: Antigua

Street Scene in Antigua, with view of the volcano "Aqua"

Street Scene in Antigua: Arch of Santa Catarina

Ruined Church of La Mercedes: Antigua



SKETCH MAP OF GUATEMALA

It was my good fortune to stay at several of these *fincas,* and none more lovely than Pacayal, a coffee plantation way up in the mountains at an altitude of 5,000 feet. It is a 30-mile horseback ride after leaving the railroad at the station of Cocales. We stopped over night at the Indian town of Patalul, where there is a new hotel, primitive but clean. We rode into this town at sunset to find ourselves in the midst of a real country fair.

It was an odd scene, the booths of bamboo and groups of dark-faced Indians squatting around camp-fires. The sound of bells and discordant music reached us, and as we came in front of the church a procession was just coming out, headed by a life-size figure of the Virgin, borne on the shoulders of women. It was the finishing touch to an already unusual scene, as it wended its way down the crooked streets between the fires, the twinkling lights of many waxen tapers and the crimson glow of the sunset heightening the already brilliant coloring of the native costumes.

THE CULTIVATION OF COFFEE AND THE INDIAN LABOR

Pacayal, an estate of some 8,000 acres, boasts some of the finest coffee in Guatemala. Coffee is not a natural product

INDIAN WRAPPING SUGAR BALLS ("PANELA") IN CORN HUSKS (SEE PAGE 609)
The half-rounded cakes on the right are unrefined sugar

ONE OF THE LITTLE INDIAN BOYS ENGAGED IN PUSHING THE LONG ROWS OF COFFEE BEANS BACK AND FORTH IN THE SUN: PACAYAL (SEE PAGE 615)

of this soil, having been introduced into the new world by a Spanish priest in Guatemala, who obtained the seed from Arabia. The trees are first raised in nurseries, and when a few months old are transplanted. A coffee field in full bloom, with its wealth of fragrant white blossoms, is indeed a beautiful sight. When ready for picking the bright red berries greatly resemble cherries.

When we arrived at Pacayal the Indians were still harvesting, the result of a good day's work being about three bushels of berries apiece. Each day these are weighed, the pickers receiving a check and being paid off in full every Saturday. They earn about seven or eight cents a day for twelve hours' work, besides a home, which consists of a bamboo hut. There is little discontent among these children of the open air, except when occasionally a bottle of "guaro," the cheap alcoholic drink of the country, is smuggled onto the estate. This is generally accomplished by some loving spouse, who travels under cover of the night and by stealth to the nearest village to obtain the coveted beverage for her liege lord.

As soon as picked the coffee is pulped to prevent fermentation in the pulp, which would stain the bean. From the pulper it goes into great fermenting tanks, where it remains from 24 to 48 hours, in order to take off the sweet, gummy substance which is on the hull. It is then washed and spread to dry in the sun on large asphalt terraces called "patios." When thoroughly dry it is put through a huller to take off the fine silvery skin, and is finally ready for the market. One bushel of berries gives ten pounds of cleaned coffee. The crop of Pacayal last year was 20,000 bags. Each bag is of 130 pounds.

We had many a delightful dance in the moonlight on these slippery patios, which at night make ideal ball-rooms.

Many children are employed all day in ceaselessly pushing back and forth the long rows of coffee beans, and at night brushing them under cover as protection from the dew. It was amusing to watch them, and we became much interested in one boy in particular as an example of what teaching and the influence of civilization can do. He had been brought to the *finca* a few years before from the mountains, where his parents were wild people, living upon raw things and knowing nothing of the uses of water except as a beverage. He had learned quickly, and during our visit was promoted to the dining-room as "assistant butler." Disliking the length of his hair, however, we attempted to cut it; but, as we only had finger-nail scissors, the result was somewhat startling. It gave his head a Marcel-wave-like effect unusual even among Indians, and from that time on he would have nothing more to do with us. His name was "Saie."

An early morning ride to the adjoining sugar *finca* of Saint Emilia was the most beautiful I have taken. Single file we picked our way through the dense tropical forest. A wilderness of giant trees linked together by trailing vines; a profusion of vari-colored orchids; a soft pink carpet of waxen begonia; great splashes of scarlet made by the peculiar blossom of the plantain, and here and there an enormous poinsettia bloom. Over all a tangled mass of blue-and-white morning-glories heavy with sparkling dew. Coming out suddenly upon the brow of a hill, we saw the white houses of Saint Emilia lying 1,500 feet below, like jewels in a green velvet case. Behind towered the mountains and in the distance sparkled the blue waters of the Pacific.

In this same part of the country, tucked still further away in the mountains, at an altitude of 8,000 feet and 40 miles from the railroad, lies the interesting city of Quézaltenango. In April, 1902, it was almost totally destroyed by an earthquake, which occurred at the same time as the wholly unexpected eruption of the volcano Santa Maria. Like the Italians who time after time fly in terror from the shadow of the dread Vesuvius and invariably return, so the people of this country only momentarily abandon their homes. In this city of

INDIANS ON THE ROAD TO QUEZALTENANGO AND CANTEL, CARRYING GREAT LOADS OF POTTERY AND FRESH FRUITS TO MARKET

INDIAN WOMEN OF CANTEL COMING FROM THE FOUNTAIN
These women make excellent workers in the cotton factory

some 23,000 inhabitants we find the unique sight of stately new buildings side by side with crumbling ruins. A partially successful attempt has been made to rebuild this once beautiful city.

The theater is, if anything, finer than the one in Guatemala City, but unfortunately stands dark and silent most of the time, as few companies venture so far from the beaten track.

The market here is unusually interesting, being the center of trade for this section of the country. In none other did I see such brilliant coloring as shown here by the costumes of the different tribes of Indians.

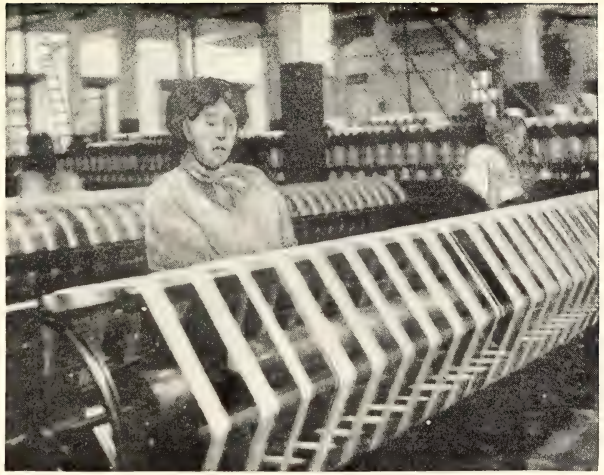
SCENES IN THE MARKET: QUEZALTENANGO

It was not far from here that I visited, at a place called Cantel, to my mind one of the greatest tributes to American energy and enterprise in the country. Nestled in a fertile valley is a large cotton factory, the only one of its kind in the republic. Think of a model factory, employing some 400 or 500 hands, where every bit of machinery used has been brought on the backs of Indians or mules. The factory hands are all Indians, mostly women and children, the dexterity of the latter being fairly astonishing.

To reach Cantel one must leave the railroad at the Indian town of San Félipe and ride 40 miles up into the mountains. We follow for several miles a level road bordered by lovely coffee *fincas,* the mountains looming ahead dark and forbidding but gradually softened by the light of coming day to a velvety, misty blue against the pale pink of the sky. The road winds almost completely around Santa Maria, which rises to the towering height of 11,000 feet.

As we drew nearer, what at first seemed to be soft, fleecy clouds proved to be clouds indeed, but of steam issuing from the great jagged crater in her side. From here the road begins to ascend, winding up, up, seemingly interminable, like a great white snake crawling into the very heart of the mountains. I was quite unprepared for the grandeur of the scenery, which surpassed anything I had yet beheld. Soft green valleys a thousand or two feet below; range after range of mountains rising on either side and looming in front like an impenetrable barrier; rushing, tumbling mountain torrents, falling hundreds of feet in

View of the Cotton Factory of Cantel, built by enterprising Americans 40 miles from the railway (see p. 617)



Looms in the Cotton Factory of Cantel

Church in the Village of Cantel. Adobe bricks spread in the sun to dry

Street Scene in the Village of Cantel

beautiful cascades; above all, the majestic head of Santa Maria lazily puffing out soft clouds of steam.

WHERE NATURE PROVIDES STEAM HEAT

Still further on the road for miles skirts the edge of a deep ravine, and, looking down hundreds of feet, one sees great columns of steam, rising geyser-like, at regular intervals. Along the way from every little crack and crevice in the rocks small puffs of steam also issue, and we suddenly shiver as the realization is borne in upon us that the path we so gayly pursue lies over the heart of a live volcano, which at any moment may again bring devastation and death to this lovely land.

Here and there were groups of sleeping Indians, huddled together wherever steam was coming from the ground. If one must sleep under the stars on frosty nights, it is surely convenient to find already prepared a system of steam heating quite equal, to all intents and purposes, to that which in modern homes is the cause of so much trouble and expense.

This is the great highway from the interior to the coast, and a never-ending stream of traffic moves constantly up and down, presenting a most interesting scene; chiefly Indians, heavily laden with every conceivable article: great loads of curious water-jars, earthen pottery, coffee, sugar, fruit, and vegetables. Then large droves of hogs and fifty or a hundred mules. Most interesting of all to me were the innumerable teams of oxen, patiently drawing great creaking loads of raw cotton destined for the far-away factory.

The lakes of Guatemala are not numerous, but are very beautiful. We have already glimpsed at Amatitlan, and, still further off, again up into the mountains, lies the crater lake of Atitlan, incomparable for beauty and magnificence of scenery.

To avoid the heat of the day—for the season was already advanced—we arranged to journey thither by night. The proceeding was a little unconventional and rather a shock to our native friends; but, then, anything was to be expected of "gringos," or foreigners. So just at sunset we mounted our mules at the station of Cocales and started gayly off on our 30-mile ride. Up and down hill, through the beautiful country bathed in moonlight; fording numerous mountain streams looking like cascades of silver; through silent Indian villages, where the inhabitants were all sleeping in the open air in front of their queer little bamboo huts. The only sound to break the silence which brooded over the land was the plaintive call of the whippoorwill and the occasional song of the nightingale.

ATITLAN, THE CRATER LAKE

At midnight we reached the borders of the lake, and at the village of San Lucas took a little steamboat that was in waiting to carry us across to the hotel on the opposite shore. The great expanse of water lay like molten silver in the moonlight, the mountains standing in serried ranks like giant sentinels to guard this treasure. A soft white haze hung over all, but not too heavy to hide the perfect outline of the two gigantic volcanoes, Atitlan and San Pédro, rising from the water's edge in one magnificent sweep to the height of 12,000 feet.

As we approached the shore a picturesque scene was revealed. The little hotel stood out white and clear against the dark background of the hill, and below, at the landing place, a group of Indians awaited our arrival, the red glare from many torches casting a lurid glow over the picture.

Owned by a German, whose business and pleasure it is to raise countless canaries, this little inn is one of the best in Guatemala. The office presents a unique appearance. From every corner comes the twittering of the tiny feathered inhabitants of many cages, and the walls are curiously papered from floor to ceiling with $50,000 worth of shares of a steamboat company, whose boats were to have plied the lake between San Lucas and Panajachel, but which failed almost

THE GREAT TURTLE AT QUIRIGUA

This is, perhaps, the most extraordinary of the monuments at Quirigua. It is a cube about 8 feet in diameter, and weighs about 20 tons. The carvings are grotesque representations of the human face and faces of animals

before it began. Easy chairs and hammocks lend a homelike look to the long vine-covered porches, and in this quiet spot the days slip by unheeded and one forgets the busy world beyond the towering hills.

By daylight the beauty and grandeur of the scene, although robbed of the charm and mystery of the moonlight, was none the less perfect.

Lying at an altitude of 5,000 feet, about 25 miles in length, this body of water has no visible outlet, although many streams empty into it. Its depth is unknown; no fish live in its icy waters. Here and there mineral springs bubble to the surface, and the shores are strewn with pumice and stones of volcanic origin. Eleven Indian towns, named after the Apostles, dot the shores, but by far the most interesting is the town of Atitlan, lying snuggled on a beautiful bay running inland between the two great volcanoes. The ground here is a mass of rocks and stones, undoubtedly the result of some volcanic disturbance, and these, loosely piled one upon the other, serve as walls for the huts, which are topped by thatched roofs. As one approaches, the first impression is that of a gigantic patch of huge mushrooms.

Here 10,000 Indians, descendants of the once poweful Quiché nation, live entirely to themselves, having an "alcalde," or governor, of their own tribe. Among them one sees more marked the peculiar and unaccountable resemblance to the Chinese, which is more or less noticeable in all of the Indians throughout the country. It is whispered that these people are fire-worshipers, but that civilization and religious teaching at one time penetrated to this far-away corner is evidenced by the ruins of a church, now standing empty and unused in the center of the town. The interior still contains some fine wood carvings and beautiful altar silver.

Never, even among the poor of Italy, have I seen so many children. We were at once surrounded by a throng of them, who accompanied us everywhere, chattering like a lot of monkeys.

The costume of these people is very effective against the dull gray background of rocks and thatched roofs. It consists only of a long piece of scarlet cloth wound tightly around the lower limbs and a loose white "guipele," or shirt. The women wear a scarlet ribbon or narrow piece of cloth wound through the braids and around the head.

Solola, a town of 15,000 inhabitants, and capital of the province of the same name, lies some 3,000 feet above the lake. Although a center of commerce, it affords little of interest to the visitor, except the magnificent view of lake and country. A large bare plaza, a ruined church, and a broad new avenue leading to a new school-house, which is painted a brilliant sky blue, are the chief attractions of the place.

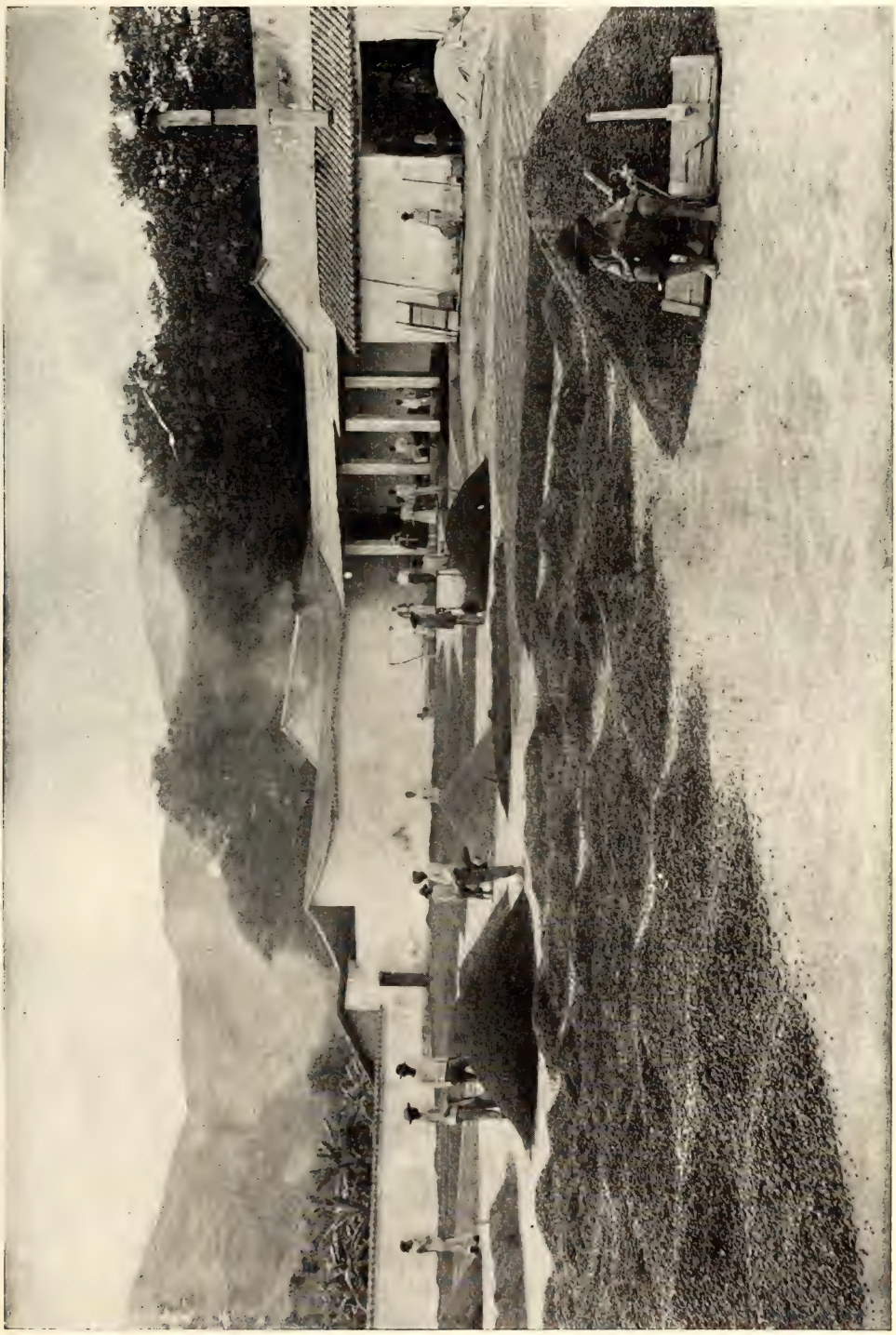
As we rode into the plaza a military band was playing, but upon our arrival the musicians hurried frantically to the end of the piece and then gave themselves up to staring open-mouthed at us. We dismounted and walked through the public gardens, a most melancholy attempt at embellishment, as the stiff flower beds were without flowers and the fountains, like the school-house, painted bright blue, were without water. The place was on the whole depressing, and, to raise our drooping spirits, we indulged in a two-step down the deserted central allée to the strains of a *Sousa* march—whether played in our honor as "Americanos" I do not know.

We were, however, well repaid for the ride. It has been my good fortune to look down upon many lakes in different parts of the world, but never have I had spread before me a more gorgeous panorama, earth, sky, and water outvying each other in deepest sapphire tones, and seven magnificent volcanoes dominating the wonderful scene.

Lake Yzabal is reached by a line of steamers, owned by a German syndicate, plying regularly between Livingston on the Caribbean and Panzos in the interior, on the Polochic River. For the first ten miles we follow the winding course of the beautiful Rio Dulce, or Sweet River,

ONE OF THE CARVED MONOLITHS OF QUIRIGUA, GUATEMALA (SEE PAGE 624)

None of these remarkable monoliths at Quirigua contain any carving or representation of a weapon of war, which is a proof of the advanced civilization and culture of the unknown people who constructed them. The illustration on this page and on pages 607, 608, 610, 611, and 620 are from "A Glimpse of Guatemala," by Anne C. and Alfred P. Maudsley.



DRYING COFFEE ON A PLANTATION IN GUATEMALA

renowned for its scenery, which is very like that of the far-famed Saguenay, in Quebec.

On each side perpendicular walls of green rise to the height of 300 to 400 feet, and at times so inclosed is it that it seems the boat must run in among the trees and overhanging vines. Then the river broadens and we come out into what is called the Golfete, a pretty body of water ten miles in length and dotted with numerous islands; through another narrow channel and out into the lake proper. Here stands the old ruined fort of San Félipe, built by the Spaniards in 1524 to g ıard the approach to the town of Yzabal, which used to be the principal port of the Atlantic coast. A sand bar, however, has formed across the mouth of the Rio Dulce, which prevents any large-sized vessels from reaching this inland sea.

Although of fresh water, many fish come up from the sea, and even shark are sometimes found here. Crocodiles are numerous, and "mantas," a species of hippopotamus, commonly called sea-cow, are also found. All the way up the Rio Dulce one sees by the hundreds the beautiful white "garza," the lovely bird from which is taken the much-desired and expensive aigrette.

Much further to the north, in a wild and sparsely populated part of the country, lies the lake of Peten, or San Andrès, of which, as yet, very little is known. On an island in the center of the lake is the city of Florès, known only to antiquaries. Here are many curious ruins and stone idols, the origin of which is as yet unknown.

There is a vast field for research in this country, where little is known of the races who were its first inhabitants. But that the ancient American civilization was highly developed is a fact beyond doubt, for the remains of numerous prehistoric cities have been discovered throughout Central America.

THE INEXPLICABLE RUINS OF QUIRIGUA

Among the most remarkable are the ruins of Quirigua, in Guatemala. Situated in the valley of the Motagua River, some 60 miles from its mouth, they are completely hidden in a thick tropical jungle, and consist of square and oblong mounds and terraces.

The chief interest, however, centers in several carved monoliths, three to four feet square and standing from 14 to 25 feet in height. The as yet untranslated hieroglyphics on these bear some resemblance to the Egyptian, although curiously enough the Greek cross can be also traced.

Many theories have been advanced as to the origin of the people whose wonderful works still stand amid the silence of the primeval forests, shrouded in the mystery of ages. There is, of course, much controversy, some ascribing to these ruins great antiquity, while others assert that they are of comparatively recent construction. No traditions have been found among the Spaniards or the Indians to shed any light upon the subject. The people who built them seem to have had a distinct, independent, and separate existence. Much attention has been given to the deciphering of these inscriptions, but still much remains to be done before the mystery will be solved. Some may date back 3,000 years or more, while the later dates on others of the Quirigua ruins may be assigned to a place at the beginning of the Christian era.

And so with the poet we can well say:

"World wrongly called the new; this clime was old
When first the Spaniards came in search of gold.
Age after age its shadowy wings have spread,
And man was born, and gathered to the dead;
Cities rose, ruled, dwindled to decay,
Empires were formed, then darkly swept away;
Race followed race, like cloud-shades o'er the field,
The stranger still to stranger doomed to yield."

Photo by Robert Shields

A NATIVE VILLAGE IN THE INTERIOR OF ANGOLA

ANGOLA, THE LAST FOOTHOLD OF SLAVERY

ANGOLA, the Portuguese colony on the West Coast of Africa, is a country about as large as France, Switzerland, and Italy combined. Its coast-line on the Atlantic is nearly 1,000 miles in length and has many good harbors. For every thousand people who have heard of the Congo Free State, which borders on the east and north, it is possible that two have heard of Angola, and perhaps one of those knows that from a time some score of years before the inauguration of the Congo State to the present day there has existed in that country a system of slavery which is only comparable with that of the Spaniards in the West Indies. Slaves are brought down from the far interior, often as far as 800 miles, by agents who think they have done well if one-half of their drove survive the journey. At the coast, knowing that it is impossible for them to return home, the slaves bind themselves to a term of service—"indentured labor," it is called—which never ends, and are shipped to the cocoa plantations of the islands of Saint Thome and Principe.

Angola is classed as a country poor in natural products of the soil and in minerals, but still moderately rich in men, in spite of having been squeezed for generations by the Portuguese. The principal agricultural products are manico, coffee, bananas, sugar-cane, and tobacco. The trade is mostly with Portugal, the chief exports being coffee, rubber, ivory, wax, fish, and palm oil.

The capital of Angola is Loanda, or

Photo by Robert Shields

A CHRISTIAN FAMILY OF LOANDA, THE CAPITAL OF THE COLONY

Saint Paul de Loanda, as it was christened, the oldest Portuguese settlement south of the Equator and once the center of the slave trade between Africa and Brazil. Its splendid harbor offers a safe haven, and it boasts of a mixed population of about 25,000. For administrative purposes the colony is divided into five districts, and at the head is a governor appointed by the Portuguese. The population is estimated at 5,000,000, the greater portion natives, and the number of Europeans being only about 4,000. They have, however, exercised a great modifying influence on the native population inhabiting the western part of the colony as regards their customs and economic condition.

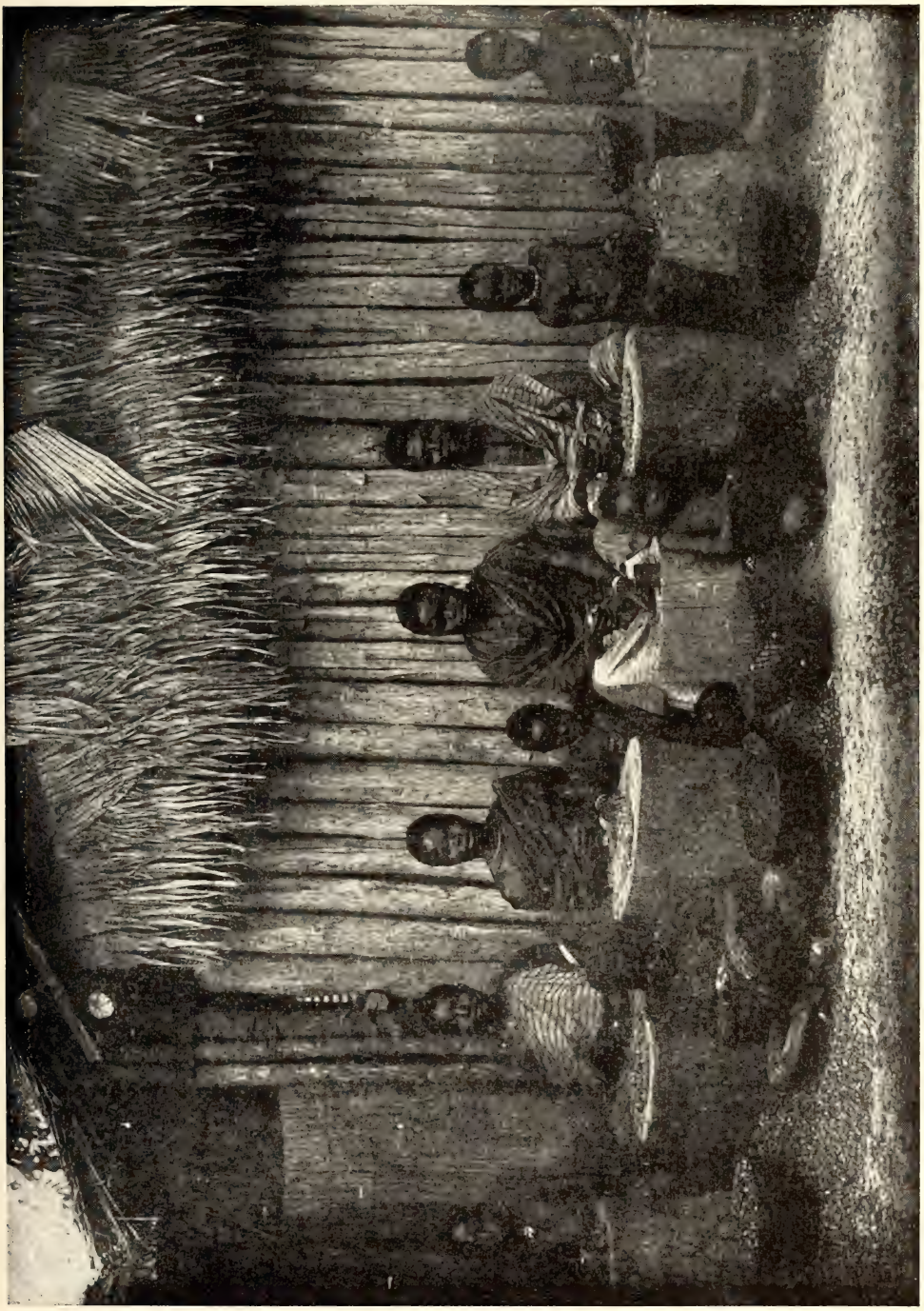
Photo by Robert Shields

TWO NATIVE WOMEN RETURNING FROM THEIR FIELDS: LOANDA

The woman on the right has been carrying her baby strapped to her back while she worked in her own fields. Polygamy prevails among the natives, and every wife has her own house, garden, and private property.

A NATIVE HOUSE IN COURSE OF CONSTRUCTION IN ANGOLA

Photo by Robert Shields



NATIVES CRACKING PALM-KERNELS FOR THE MARKET: ANGOLA Photo from Bishop J. C. Hartzell

Photo by Robert Shields

NATIVE CHIEF WITH HIS PRIME MINISTERS AND A FEW OF HIS SUBJECTS IN ANGOLA

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THE NATIONAL GEOGRAPHIC MAGAZINE

THE SOUTHWEST

Its Splendid Natural Resources, Agricultural Wealth, and Scenic Beauty

BY N. H. DARTON, OF THE U. S. GEOLOGICAL SURVEY

THE southwestern section of the United States is a province that presents many special characteristics of physiography, climate, resources, and capabilities which are not as well known as they deserve to be. The term "Southwest" is usually applied to New Mexico, Arizona, and southern California, an area of about the size of New England, New York, Pennsylvania, Maryland, and the Virginias. Much public attention has of late been attracted to Arizona and New Mexico in connection with their admission to statehood, and one gratifying result of this has been a greatly increased interest in their resources and conditions.

Excluding the populous and thrifty coast region of southern California, the Southwest is the most thinly populated and least developed portion of the country south of Alaska. As this condition is due mainly to a climate so arid that but little can be raised without irrigation, its future development is to be measured by the utilization of the vast volume of flood waters now going to waste. This water can be applied to millions of acres of level lands with rich soil, which with the unending sunshine of its mild climate will respond with large and profitable crops.

Unfortunately, there is not enough water for all the land, but there is sufficient, if all were utilized, to support a population many times as large as the present one. The Government is now spending $12,000,000 in reclamation projects in Arizona and New Mexico, which will supply water for nearly one-half million acres of fertile lands. This will give great impetus to development, and in time, when settlers take up the reclaimed land, there will be a large increase in its agricultural productions.

In the great coast region of southern California, with a population of nearly 600,000, the principal product is the orange and other fruits, with a value of about $20,000,000 a year, while in the inland districts the mining industry is the largest source of revenue. Portions of the Southwest are richly productive of various minerals, notably those of copper, and recently southern California has become a heavy producer of petroleum. The value of the copper, oil, and other products of the ground aggregates about $75,000,000 a year.

It is probable that further exploration will disclose large additional supplies of ores of various kinds, especially those of low grade, which will prove profitable under improved methods of reduction.

MAP OF SOUTHWESTERN UNITED STATES

MOUNTAINS AND RIVERS

As shown in the map (page 632), the Southwest presents a variety of topographic features, and many of its economic resources are closely related to them. There is great range in altitude, with corresponding variation in climatic conditions. One of the most salient features is the wide high plateau of northern Arizona, which reaches an altitude of 8,000 feet. It is surmounted by various volcanic peaks, notably San Francisco Peak, which is 12,611 feet above sea level.

To the east this district merges into an irregular series of high plateaus, constituting the western half of New Mexico.

To the west and south it drops by huge steps into the great region of desert valleys or bolsoms of Nevada, western Arizona, and southeastern California. These deserts are wide long plains, lying between mountain ridges of varying lengths and heights, ridges which are all very rocky and mostly treeless and trend north and south.

Diagonally across southern California there extends the long curving ridge of the Sierra Madre and San Bernardino Mountains, between which and the ocean lies the large oval area known as the valley of southern California. This valley is the great citrus fruit district, and Los Angeles, Riverside, and the many other settlements lie on its gentle seaward slope.

There are two great rivers in the Southwest, the Colorado and the Rio Grande. The Colorado River has been compared to the Nile and the similarity is notable. Both are streams of the first rank, rising in high mountains, and finally crossing a broad region of semi-tropical, nearly rainless deserts. Both empty into seas in nearly the same latitude, and their lower courses are through wide deltas of fertile soil. The annual overflows add new sediments fertile with plant food and at a time favorable for the crops.

The agricultural capabilities are closely similar, but while much of the lower Nile Valley is utilized the Colorado Valley is just beginning to be settled. The watershed area of the Colorado, with its two head branches, the Green and the Grand, is over 200,000 square miles, its course 2,000 miles in length, and its annual discharge is 11,000,000 acre feet, or enough to cover that number of acres one foot deep.

The sediment which it carries each year into the gulf is estimated to be sufficient to cover 53 square miles one foot deep. For 200 miles of its course across the high plateau of northeastern Arizona it cuts the wonderful Grand Canyon, which in places is nearly a mile deep. South of the canyon it flows mostly in broad valleys, but cuts through several desert ridges, finally passing out into the wide delta plain extending to its mouth.

The Rio Grande is a large river rising in the mountains of Colorado, traversing New Mexico from north to south, and finally constituting the boundary line between Texas and Mexico. Its volume in central New Mexico varies from 200,000 to over 2,000,000 acre feet a year, with an average probably near 1,000,000.

THE DESERTS

The definition of a desert given by the dictionaries, "a dry sandy region without vegetation or inhabitants," is defective, and the idea that it is necessarily flat is erroneous. Most portions of the average desert bear an extensive, though somewhat widely spaced, flora. Many desert regions contain numerous settlements, the Sahara Desert for instance having a population of 2,500,000. Loose sand is a minor feature, and much more prevalent on the seacoasts and along the bottom lands of rivers. There are wide areas of bare rocks, and the larger deserts include mountains, ridges, mesas, and deep canyons.

The deserts of the Southwest are regions of very scanty rainfall, parts of them having only three inches a year and evaporation of eighty inches or more. Most of the rain descends in very heavy local storms which give rise to short-lived torrents, sometimes of great volume.

I have witnessed such storms, in some

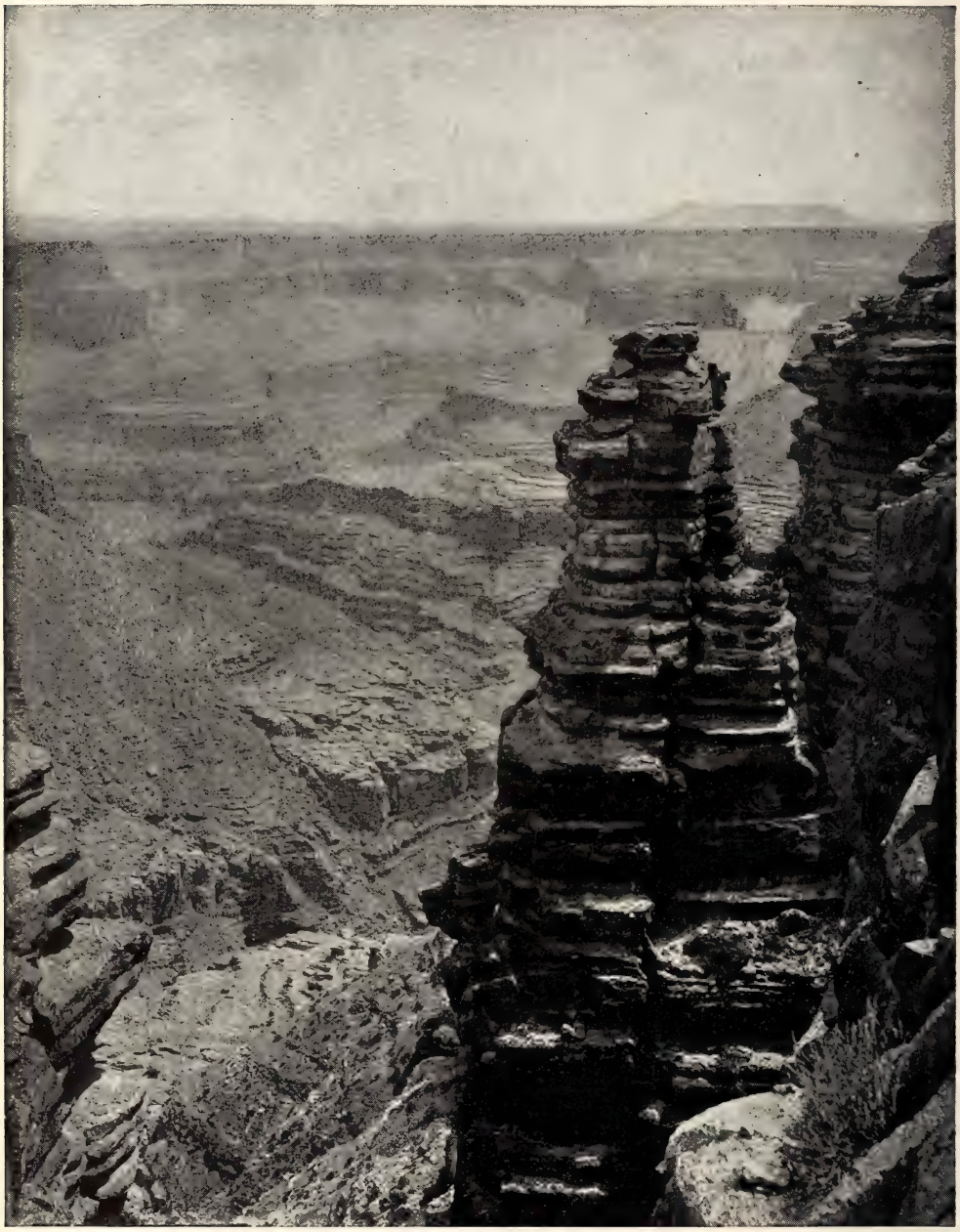


Photo by J. K. Hillers

GRAND CANYON OF THE COLORADO AT THE JUNCTION OF THE LITTLE COLORADO, LOOKING EAST TO SHINIMO ALTAR: ARIZONA

The river flows 4,000 feet below the plateau

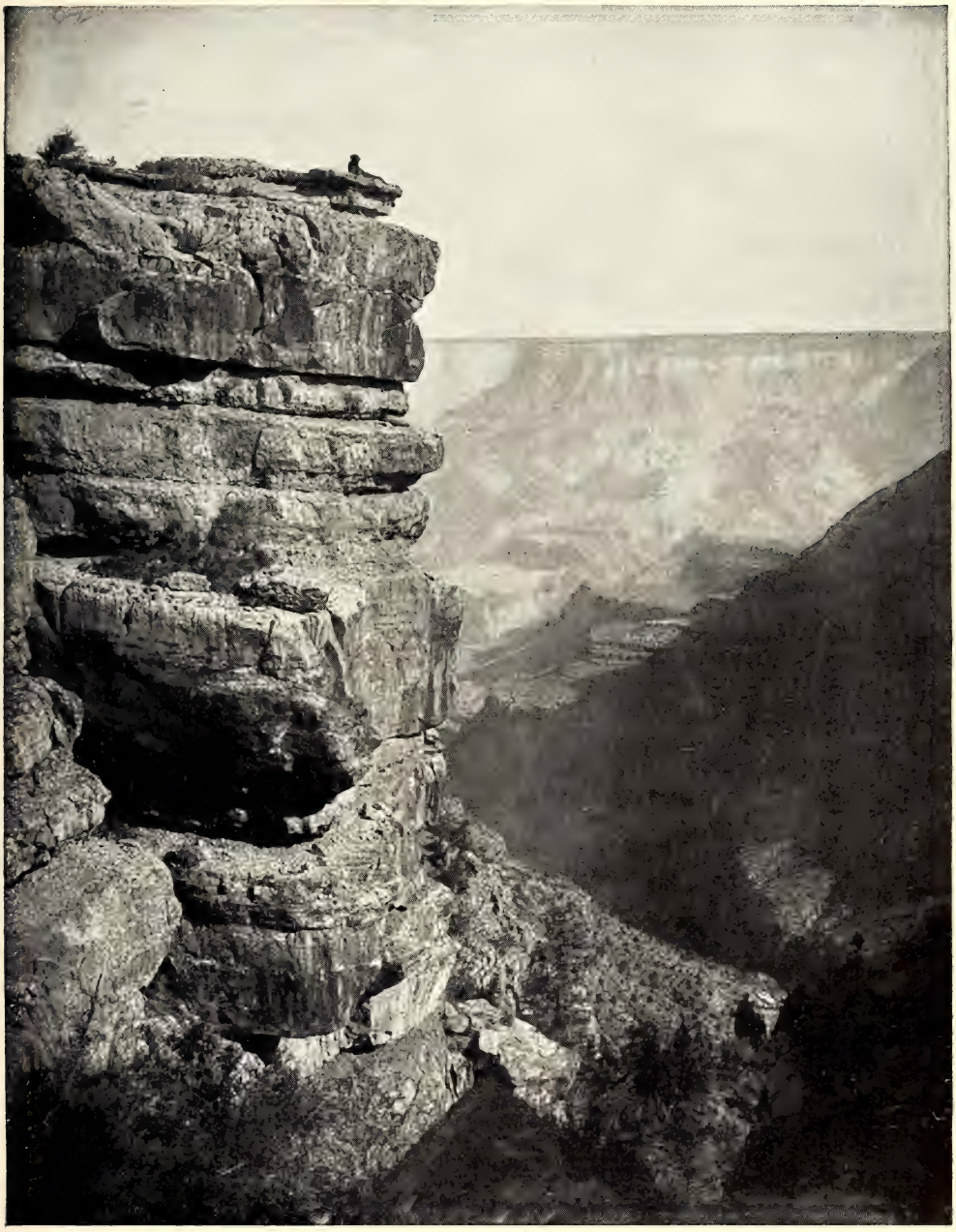


Photo by J. K. Hillers

GRAND CANYON OF THE COLORADO, NEAR THE HANCE TRAIL

Depth, about 4,000 feet, looking east

cases far in the distance, and as a result seen a dry wash suddenly fill with a stream 20 feet deep advancing in successive high waves. The flow would last a few hours, rapidly subside, and perhaps the wash would not be a water course again for several years.

The several large rivers that flow across deserts of the southwest accumulate their waters from melting snows and heavy rainfall in distant high mountains.

The temperatures in the deserts of the Southwest rise high in midsummer, often attaining 125 degrees in the lower lands of Death Valley and the lower Colorado Valley.

The desert vegetation is always a source of interest to the traveler, especially the varied and conspicuous cactus flora. The Saguaro (*Cereus giganteum*) of central and southern Arizona (page 651) is one of the most notable forms. It lives in areas where the precipitation is only three or four inches a year, but is restricted to the warmer districts. It has wonderful capacity for rapid absorption of a large amount of moisture, whether from a heavy downpour or a slight dampening.

The biznaga (*Echinocactus emori*), also known as watermelon or barrel cactus, is an associate of the Saguaro, and I can add my testimony to its usefulness as a most important water bearer. By cutting off its top and beating up the pulp with a stick one can secure a draft of watery juice of fair flavor which will effectively quench the desert thirst.

I once spent the month of November in the deserts of southeastern California investigating artesian waters for the Santa Fé Railroad, and the experience was one of the most delightful of my life. The climatic conditions were perfect, and the region was full of novel features of geology, flora, physiography and scenery which kept me greatly interested throughout the trip.

One must live awhile in the desert to realize its many charms. The brilliant sunsets are especially impressive, and the glowing twilights followed by marvelous effects of light and shade at nightfall piles great velvety shadows along the slopes of the mountains.

The Southwest, however, is rich in features that interest even the most casual observer. The most notable is the Grand Canyon of the Colorado, which is in many ways the greatest natural wonder in the world.

THE GRAND CANYON

This canyon is the mile-deep gorge cut by the Colorado River across the high plateau of northern Arizona. The view from the rim reveals the most stupendous panorama imaginable, for one sees into an area of about 600 square miles filled with an endless variety of most rugged topographic forms of many beautiful colors. On the sky-line, 10 to 15 miles away, is the edge of a wide-reaching plateau, and in the middle ground of the picture flows the Colorado River, nearly a mile below one's feet.

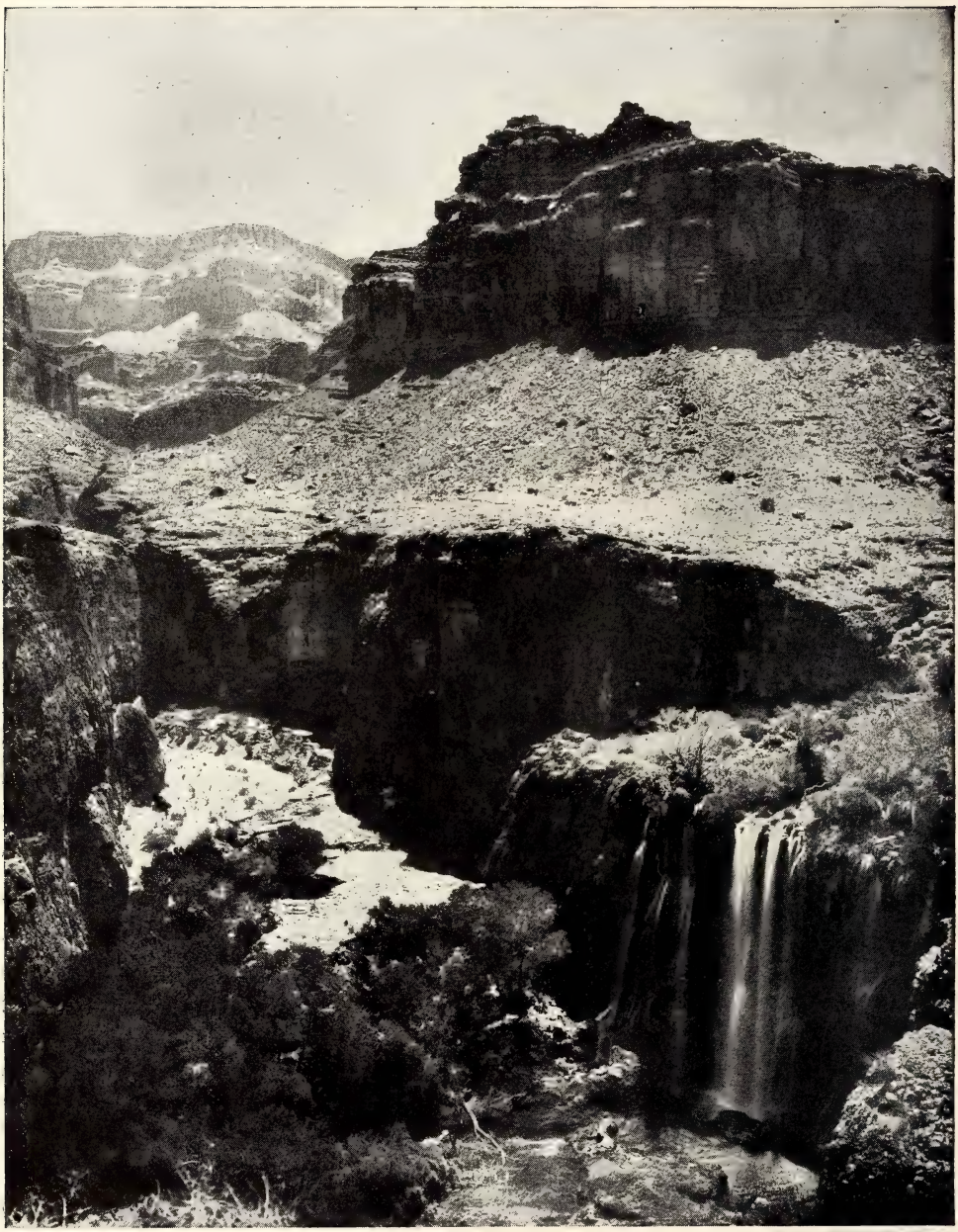
The features are so gigantic and so plainly in view that all sense of scale is lost, and it is not until one has been down to the bottom of the canyon at the river level that any adequate sense of proportion can be gained.

It is not a smooth-walled canyon of simple type, for, instead, the descent is by a succession of great cliffs and long, steep slopes, and the walls are an alternation of deep recesses and far-reaching promontories. Some of the latter are several miles long, and broken into irregular buttes of many forms.

The canyon is a most superb illustration of direct erosion, for the primary agency in its formation has been flowing water. The movement of talus down slopes, the action of frost, and the sculpturing by wind-blown sand have had an influence in the final details. Certain differential earth movements—faults and flexing—have also caused some modifications of contour. The configuration of the features in the canyon are closely related to rock texture; the great cliffs, many of them 600 feet high, and the plateau, are due to nearly horizontal limestones and sandstones of very mass-

Photo by J. K. Hillers.

NAVAJO CHURCH, A PRODUCT OF EROSION IN CROSS-BEDDED GRAY SANDSTONE, EAST OF GALLUP, IN WESTERN NEW MEXICO



NAVAJO FALLS, ON CATARACT CREEK, IN HEART OF GRAND CANYON REGION: ARIZONA

The cliff to the left is about one-half mile high

ive character, while the slopes are mostly of shale and talus. The inner V-shaped gorge, 1,000 to 1,200 feet deep, in which the river now flows, is eroded in granitic rocks. The succession of strata presented in the canyon walls near El Toval Hotel is as follows:

Kaibab limestone.—Light-colored limestone, cherty in upper part, 700 feet.

Coconino sandstone.—Gray massive cross-bedded sandstone, 300 feet.

Supai formation.—Red shale and red slabby sandstone, 1,100 feet.

Redwall limestone.—Very massive gray limestone, mostly red on surface, 550 feet.

Tonto formation.—Slabby sandstones and greenish shales on massive basal sandstone, 700 feet.

The basal sandstone of the Tonto lies on granite and gneiss, of which over 1,000 feet are exposed, but locally on the opposite side of the canyon the Tonto is underlain by a mass several thousand feet thick, of Unkar formation, consisting of red sandstone, limestone, and basalt of Algonkian age.

The rim of the canyon near the hotel El Tovar has an elevation of 6,866 feet, and on the river bank below there is a U. S. Geological Survey bench mark reading 2,436, a drop of 4,430 feet. The river appears like a silvery thread when viewed from the rim of the canyon, but on going to the bottom of the granite gorge the river is found to be 250 feet wide, 20 to 30 feet deep, dashing along with a declivity of about 13 feet to the mile, and in places broken by strong rapids. One can then appreciate the heroism of Major Powell's famous trip down the river in 1869—a thousand-mile voyage in small boats through the entire length of this then unexplored canyon.

The canyon was discovered by Cardenas, who went to its edge in 1540 on a branch trip from Coronado's expedition, on information obtained by Tovar from the Hopi Indians. The original name given to the river was Tison, Spanish for firebrand, and it is to be regretted that the name has not been retained to avoid the present confusion due to the river having the same name as the state.

Formerly to reach the Grand Canyon it was necessary to stage 60 miles across the plateau, but now there is a branch from the Santa Fé railroad at Williams which takes the tourist to the fine hotel El Tovar, built on the brink of the canyon at one of the best view points.

SOME NATURAL WONDERS

Coon Butte, another of the greatest wonders in our country, is also situated in the Southwest, but owing to its distance from the railroad it is seldom visited. It is a great crater-like bowl in the plateau, about 10 miles south of Canyon Diablo station. The "crater" is about 4,000 feet wide and 600 feet deep, with an irregular encircling rim of loose rock fragments from 120 to 160 feet high. The wall of the depression shows broken-off edges of sandstones and limestones considerably upturned, and the rim consists of the ejected material. Some have advanced the theory that the features are due to the impact of a huge meteor, and a mining company has spent large sums drilling holes to find the iron or other meteoric material, but without success. Mr Gilbert's suggestion that the cause was a great volcanic steam eruption is much more plausible, however, for there are numerous volcanic vents at no great distance.

The petrified forests attract many visitors, especially the most accessible one south of Adamana, a station on the Santa Fé railroad a few miles east of Holbrook. There is a large quantity of the material in sight here, some of it in large logs. One of these logs spans a small draw as a natural bridge.

Arizona possesses a very picturesque natural bridge of limestone spanning Pine Creek, in Gila County, 70 miles south of Flagstaff. It does not, however, rival the great bridges recently discovered in Utah. Its span is 80 feet, its height about 125 feet, and its length up and down the creek is over 400 feet.*

Canyon de Chelly is one of the most notable scenic features in Arizona (see

* See "The Great Natural Bridges of Utah." By Byron Cummings, pp. 157-167, NAT. GEOG. MAG., February, 1910.

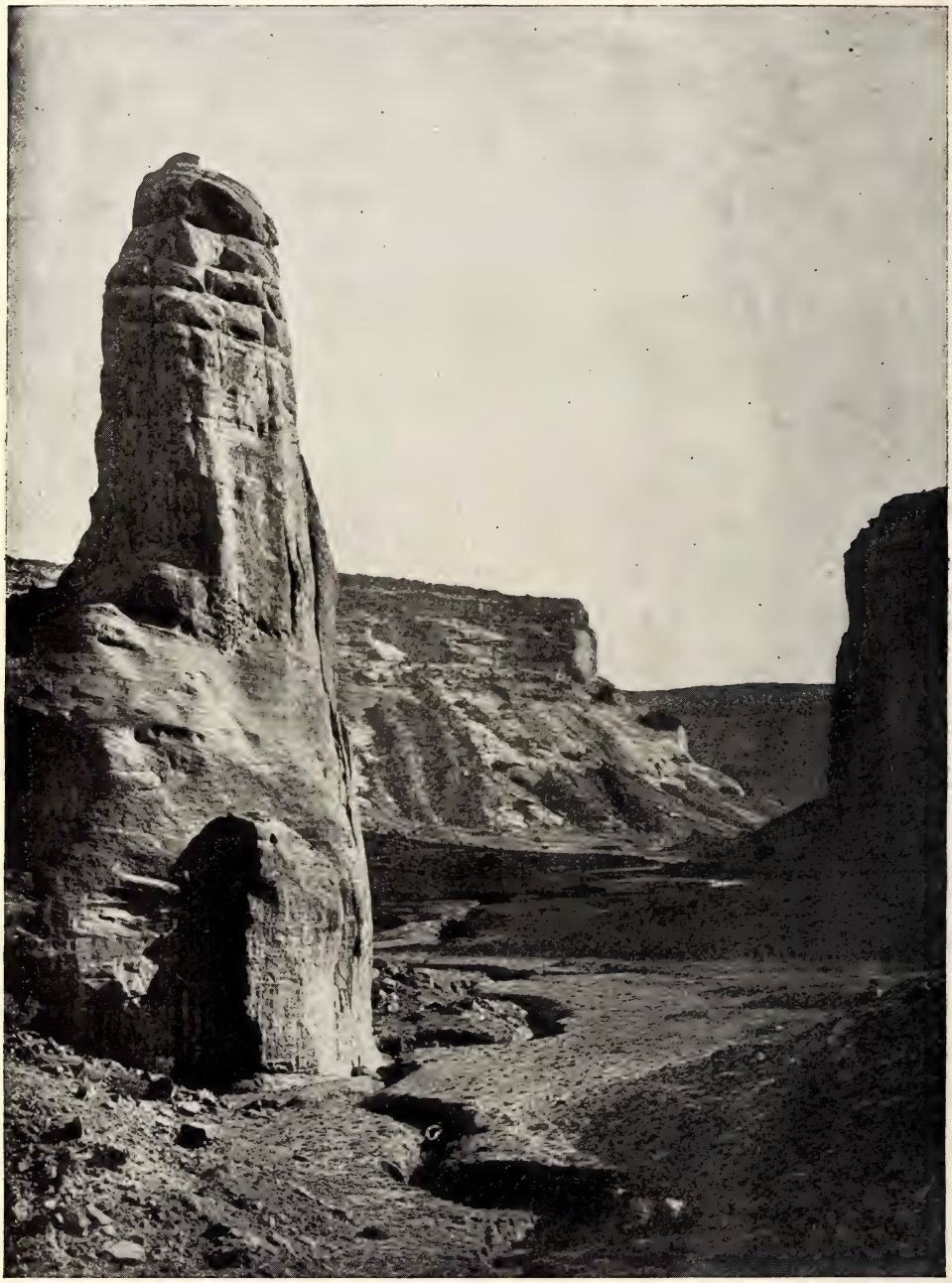


Photo by J. K. Hillers

CLIFFS AND PINNACLES OF RED SANDSTONE IN CANYON DE CHELLY, NORTHEASTERN ARIZONA

Note the man at foot of high pinnacle

CAPTAINS OF THE CANYON: 600-FOOT CLIFFS AND PINNACLES OF RED SANDSTONE IN CANYON DE CHELLY, NORTHEASTERN ARIZONA (SEE PAGE 639)

A CINDER CONE NEAR SAN FRANCISCO MOUNTAIN Photo by G. K. Gilbert

The product of very recent volcanic outbursts, rising over 200 feet, and just as fresh as if made yesterday

page 640), but it is so far off the main line of travel that it is rarely visited. It is cut deeply into soft sandstones, which rise in vertical walls, with many outlying pinnacles and monuments. Some of these features appear also in the great wall of red sandstone on the north side of the wide depression through which the Santa Fé railroad crosses the continental divide east of Gallup. One of the most remarkable pinnacles of this wall is fancifully termed the Navajo Church, shown on page 637.

THE FORESTS

Few persons who travel across the Southwest realize that in Arizona and New Mexico there are enormous forests of valuable timber and that the lumbering is an important industry. In both territories there are several large forest reservations, and one of these in Arizona, the Coconino Forest, with nearly 6,000 square miles, is the largest single reserve in the United States. The total forest area reserved in Arizona is 15,250,130 acres, or more than 24,000 square miles, and in New Mexico there are 10,971,711 acres, or more than 17,000 square miles. Southern California also has several large reserves.

The Coconino Forest in Arizona occupies part of the great plateau in which the Grand Canyon is cut, and extends to the brink of the canyon. It covers a wide area about San Francisco Mountains, and extends southeastward for 200 miles along the south edge of the plateau to New Mexico. Its extension in that territory is known as the Datil and Gila reserves, comprising 4,652,450 acres, the largest reserved area in the country. There are other large reserves in various portions of both territories.

The principal tree in these forests is the western yellow pine, and not the white pine, as commonly reported. Its lumber is only of moderate value as compared with high-class woods, but its local importance is very great. The trees grow from 80 to 125 feet high, and many of them 3 feet in diameter. In 1908 this pine constituted 96.5 per cent of the lumber cut in Arizona and 87.7 per cent of the cut in New Mexico.

There is now great interest in the cultivation of Eucalyptus in California, and many large groves have been started as a business enterprise. Several varieties of the tree were introduced many years ago, and most of them show remarkable growth and high value for many purposes. One of the railroad companies has planted about 4,500 acres to raise trees for ties, piling, and other uses. In some cases a tree will attain a height of 100 feet in six years, but some of the more rapid growing varieties have less satisfactory timber than is obtained from those of slower growth. One good feature of the tree is that it will grow on soils that are of but little value for agriculture.*

THE INDIANS

The visitor to the Southwest usually takes keen interest in the Indians, who are numerous not only along the main lines of travel, but in many remote villages. Some tribes, notably the Apaches, who continued to be troublesome until a relatively recent date, have become famous for the misdeeds that materially retarded the development of Arizona and western New Mexico. Now, however, all is peace and tranquillity. The newspapers, especially Eastern ones, occasionally print accounts of uprisings, but these prove to be local quarrels with a few individuals.

The Indians of the Southwest are of two kinds, differing greatly in most of their characteristics: One is the nomad type, represented by the Apaches, Navajos, the Yumas, Papagos and Pimas, and smaller tribes; the other is the pueblo type, which is comprised in 26 pueblos, or villages, scattered through central and western New Mexico, and in the Hopi Reserve, in northeastern Arizona.

Probably there is greater popular interest in the pueblo people, for their settlements are permanent and mostly very ancient, and their religious ceremonies are extremely elaborate and picturesque.

* See NAT. GEOG. MAG., July, 1909, pp. 668-673.

They live in villages of several hundred inhabitants, in substantial stone or adobe houses, some of which are in groups, rising in tiers to a height of four or five stories, with streets and central plaza. They are peaceful and industrious, raising crops largely by irrigation. They have herds of cattle and sheep, and spinning, weaving, and making their garments is one of their important occupations.

Work appears evenly divided between man and woman in the pueblos. The men do the farming, tend to the cattle and sheep, do the hunting, build the houses, and have many smaller trades and occupations. The women do the housework, grind the corn, make pottery, blankets, and clothes.

The visitor is generally impressed by the pueblo people, and pleased with the agreeable home life and the simple hospitality which they readily offer.

Zuñi is notable in this respect, and although it is far out of the usual line of travel it well repays a visit. The houses are built of adobe—bricks of sun-dried clay—and rise in tiers on the hill slope, as shown on page 652, so that in many cases the roof of one is the front yard of the next. All are provided with windows and doors, and inside there are clean whitewashed walls and fairly high ceilings, supported by long stout logs. The floor is adobe, smooth and clean. At one corner is an open fireplace, but cookstoves are not uncommon. The furniture consists of chairs and board tables, while for beds skins are spread on the floor. At night kerosene lamps give light. One can spend a very pleasant evening in such a home with the bright cheerful Zuñi men and women, and find the conditions quite equal to and even better than the standard of the lower-class ranches of the West.

Many visitors go to the Hopi villages, 75 miles northwest of Holbrook, to witness the snake dance and other ceremonies, and Zuñi, Taos, Acoma, and other pueblos are occasionally visited by the sightseers. Laguna, on the Santa Fé Railroad, a few hours west of Albuquerque, is the best known by sight, for all of it is visible from the train.

The elaborate religious beliefs and observances of the Indians of the Southwest have been the subject of many volumes, and although some of the Christian churches claim a few converts, the simple people of the pueblos prefer to cling to their own ancient traditions.

In earlier days, long prior to the discovery of the continent by Europeans, the Southwest was occupied by a large population of agricultural people, with extensive settlements in many of the valleys. We now find ruins of the villages, traces of their irrigation works, and old hiding places among the cliffs, which throw much light upon their character, occupation, and history.

The pueblo people of the present appear to be their descendants, but they are only a handful compared to those of the earlier times. It is evident that they were victims of the predatory Indians from the North, notably the Apaches, and there are many traditions among the surviving tribes of the ruthless warfare which their ancestors suffered.

TOURISTS

The interesting features of the Southwest, notably the beauty of the coast region and the special climatic advantages, draw a large number of tourists and health-seekers, especially in winter, and every year sees a substantial increase in the influx of visitors.

Southern California is the principal destination, and Los Angeles, Pasadena, and the beach resorts receive a great throng of sightseers. Many of them also go south to San Diego and the nearby Coronado Beach, where the magnificent Del Coronado Hotel delights the visitor. Others content themselves with a visit to Los Angeles and Pasadena and go north through Santa Barbara and other places to San Francisco. Phœnix, Arizona, receives a moderate share, notably of the health-seekers.

The conditions of travel and living in the Southwest are similar to those in most other portions of the West. Two

OSTRICH ROCK: AN EROSION FEATURE IN THE PETRIFIED FOREST OF ARIZONA

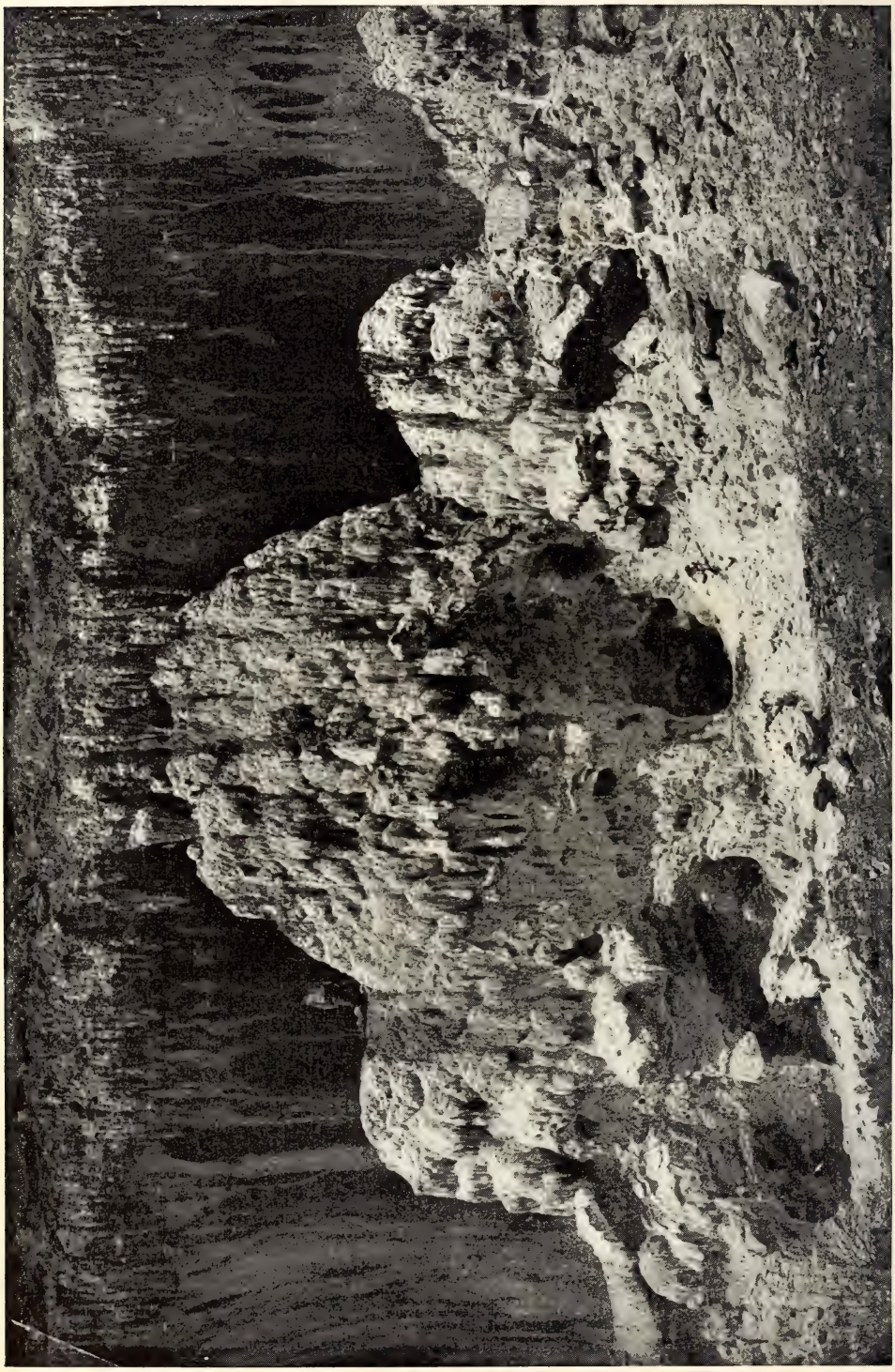
great railroad systems cross the country from east to west—the Santa Fé in the north and the Southern Pacific in the south—with various branch lines in different directions. Hotels are plentiful along the main lines of travel and throughout the valley of southern California, but especially noteworthy are the high-class mission-style hotels of the Harvey system strung along the Santa Fé lines in Arizona and New Mexico.

THE SOUTHWEST FOR HEALTH

Because of its dry air and mild climate, the Southwest has become famous as a health resort, especially for those having tuberculosis of the respiratory organs. The percentage of cures made in New Mexico, Arizona, and California, great as it is, would be much greater if a larger proportion of those who are seeking health came in time. It is necessary to come before the vitality is too greatly diminished and then to live under favorable conditions, the most essential of which is to be out of doors as much as possible.

"Lungers," as such invalids are termed, are not welcomed in the cities and larger settlements, and some hotels will not receive them, but there are many special resorts, such as tent colonies and sanatoriums for them. In the smaller villages and through the country there is usually no difficulty in securing accommodations.

Unless the affected person has some means to invest in a place of his own he is at considerable disadvantage, for it is difficult to obtain suitable employment. Living expenses are somewhat higher in the Southwest than in the central and eastern states, especially in the larger cities. Very little provision has been made for indigent consumptives, and many sick persons without means suffer great hardship in trying to sustain themselves after coming to the Southwest.



CAVERNS IN THICK DEPOSITS OF PURE ROCK SALT ON BANK OF SALT RIVER, IN MOUNTAINS OF CENTRAL ARIZONA

Note the man in upper left corner

Many health-seekers spend most of their money in railroad fare to reach the desired resorts. Physicians do a great wrong to patients in sending them so far from home, friends, and care without means to provide suitable quarters, nourishment, and attention to sustain them while making their fight against death.

It is found that different climatic conditions have important bearing, some persons deriving greater benefit from the dry cool highlands, while others prefer the lower deserts or the moister seacoast. In most cases the high summer temperature of the lowlands is too debilitating, and it is necessary to go into the highlands for the summer.

The Government has established a marine hospital at Fort Stanton and an army and navy hospital for consumptives at Fort Bayard, both in the highlands of New Mexico.

CLIMATE

The climate of the Southwest presents considerable variety, but in all the lower lands the winters are delightfully mild, and everywhere blue sky is in evidence for more than 300 days in the year. The summers are warm; in the southern desert area they are decidedly hot for several months, but the dry air even then is much more endurable than the sultry summer weather of the eastern and central states. Sunstroke is unknown, and laborers continue their work without distress.

While the temperature in the deserts of southern California and Arizona often rises to 120 degrees in the shade, if perspiration is sustained by plenty of water, the average person suffers no great inconvenience. Most of the nights are decidedly cool excepting in the lower lands farthest to the south.

The conditions in the deserts are well illustrated by the following table of monthly temperatures and rainfall at four typical desert stations.

On the higher lands of Arizona and New Mexico the summer weather is altogether agreeable, and in southern California west of the mountains the summer temperatures are moderate owing to the sea breezes which are nearly always in motion. The table on page 650 gives the average weather conditions, 1897-1909, at Redlands, California, which is typical of much of the coast region of southern California.

Temperatures and Rainfall in Desert Regions in the Southwest.

	Fort Yuma.			Phœnix.			Tucson.			Mohave.		
	Max. temp.	Min. temp.	Mean rainfall.	Max. temp.	Min. temp.	Mean rainfall.	Max. temp.	Min. temp.	Mean rainfall.	Max. temp.	Min. temp.	Mean rainfall.
Years observed.	26	26	20	17	17	22	6	6	15	5	5	26
	°	°	*Inches.*	°	°	*Inches.*	°	°	*Inches.*	°	°	*Inches.*
January	81	22	.42	87	12	.80	80	17	79	70	16	.95
February	91	25	.61	92	19	.70	83	17	.90	78	20	.92
March	100	31	.26	97	24	.58	92	22	.77	83	26	.75
April	107	38	.07	105	30	.30	30	95	.28	100	35	.17
May	112	44	.04	113	35	.13	102	32	.14	102	38	.03
June	117	52	T.	119	33	.10	112	48	.26	107	48	.05
July	118	61	.14	116	46	1.03	108	59	2.40	115	64	.08
August	115	60	.35	116	49	.88	109	57	2.60	112	57	.04
September	113	50	.15	114	39	.64	107	49	1.16	104	45	.07
October	108	41	.28	105	34	.37	98	29	.64	93	40	.25
November	92	31	.29	97	24	.54	90	21	.81	84	27	.40
December	83	24	.46	95	18	.86	83	10	1.00	70	15	1.26
Year	118	22	2.84*	119	12	6.93	112	10	11.74	115	15	4.97

* 26 years' observation.

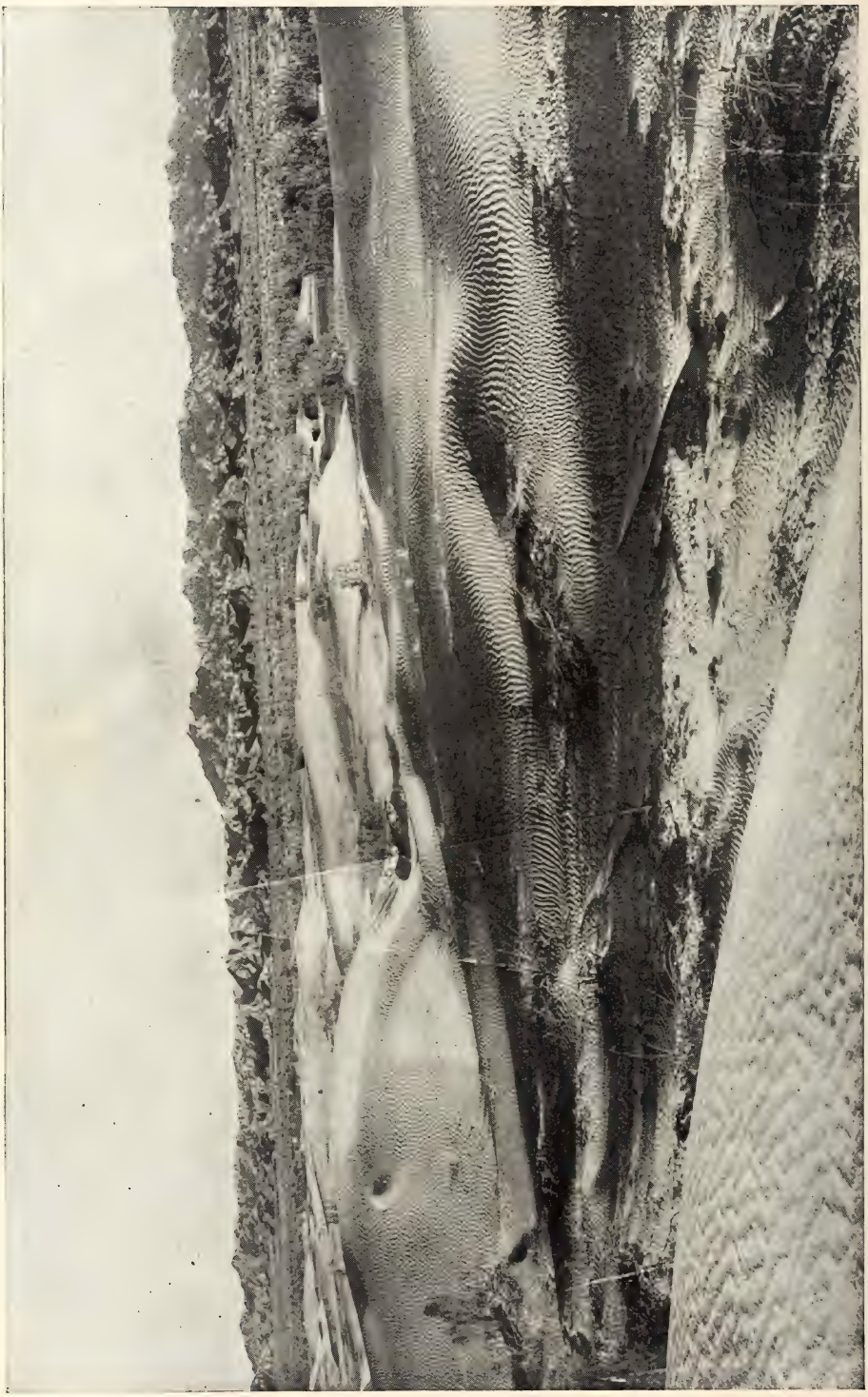
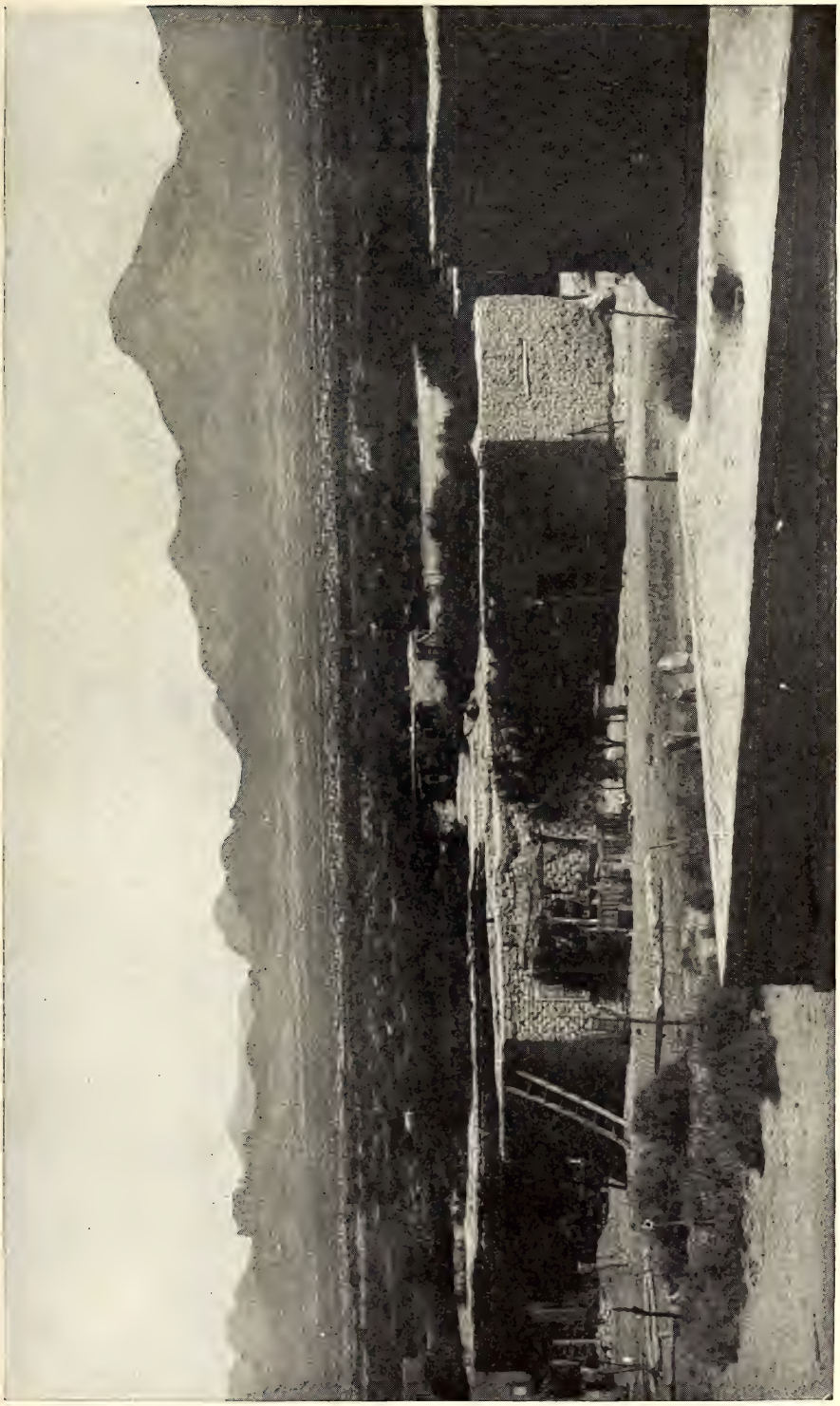


Photo by W. C. Mendenhall

SAND DUNES IN THE COLORADO DESERT OF SOUTHERN CALIFORNIA (SEE PAGE 633)



DONA ANA MOUNTAINS, CENTRAL NEW MEXICO, FROM TOWN OF DONA ANA

Typical Mexican adobe residence in foreground

Average Weather Conditions at Redlands, California, 1897–1909

	Mean humidity.	Mean temperature. Max.	Min.	Daily.	Average rainfall.
January	43	63	40	52	2.64
February	48	66	42	54	2.37
March	42	70	43	56	3.08
April	32	74	47	60	1.85
May	44	76	50	63	1.76
June	36	88	54	71	.17
July	26	95	58	77	.01
August	27	95	59	77	.16
September	28	90	56	73	.27
October	33	81	50	66	.74
November	35	72	45	58	1.04
December	32	67	41	54	.95
Total for the year					15.04

Only 16 per cent of the days are cloudy and rainy. The rainy days average but 15 in a year. During all these years the temperature has exceeded 100 degrees in July, August, and September on an average of only fifteen times a year, and has fallen below 32 degrees on an average of less than three times a year. The wet bulb thermometer is usually less than 20 degrees below that of the dry bulb. The lowest recorded temperature of 25 degrees was only reached twice. January, February, and March are the wettest months.

The valley of southern California is protected from the cold northern winds of winter by high mountain ranges, while to the south it is open to the Pacific. Owing to the peculiar configuration of the coast the cold California current from the north is deflected west near Point Conception, and hence the southern California shores have waters warmer by about 10 degrees than those to the north. Then, too, the mountain barriers afford protection from the heat of the dry hot deserts to the east, and they cause precipitation which affords running water in fair volume in many streams. These mountains are so high that the winter snows linger on them far into the spring, when southern California is gay with its innumerable flowers.

FRUIT OF SOUTHERN CALIFORNIA

This beneficent climate is responsible for the giant industry of fruit growing which has made California famous over the globe. California furnishes the major part of the very large amount of oranges and other citrus fruits consumed in the United States, and this business has been the potent cause in the development of southern California. Ever since the early days of settlement it was known that climate and soil were favorable, but it was not until about 20 years ago that the great orchards were developed. The splendid success of the business led many to engage in it, until finally most of the available land came under cultivation.

There are two important natural limitations to the extension of orange culture—one is lack of water; the other is frost. Water for irrigation is a necessity, and as the available supply is limited only a certain acreage can be utilized.

At an early period all the surface waters were taken out in ditches, and then the underground waters were tapped by numerous wells. Storage dams have helped to conserve the surface waters somewhat, but the artesian supplies have been drawn on beyond their capacity for replenishment, and they are steadily diminishing in some districts of large extent.

A few years ago hydrologists of the U. S. Geological Survey made a careful investigation of the amount of underground waters available, and placed the data on maps and diagrams which will afford a definite basis for the water conservation. There are frequent lawsuits concerning underground waters, most of them brought by the man with the little pump when he finds that the company with the large pump is drawing away his water. There are about 3,000 flowing wells and 7,000 pump wells now supplying water for irrigation, with an estimated total volume of about 500 second feet.

The area of agricultural land in the fruit district is about one million acres, of which about one-fourth have water for irrigation and are cultivated. The remaining three-quarters is without water. The new water supply for Los Angeles will be about 260 million gallons

GIANT CACTUS (SAGUARO) OF REMARKABLE FORM ON DESERT SOUTHEAST OF PHŒNIX, ARIZONA

THE PUEBLO OF ZUÑI, IN WESTERN NEW MEXICO

Photo by J. K. Hillers

a day, or ten times as much as is now needed, and the surplus will be used for irrigation until it is required by the city.

The orange and other citrus fruits of southern California have an output of about 30,000 carloads a year, with a net value of more than $15,000,000. Of this, Riverside ships 4,000 to 5,000 cars of oranges, worth $2,000,000 net. Redlands' shipments in 1909 were 4,551 cars of nearly 2,000,000 boxes, valued at $2,764,000. Olives are also a prominent crop, yielding a large aggregate return. Besides her fruits, California raises a great variety of nuts and vegetables. The single item of walnuts sums up $1,500,000 a year. Lima beans, $2,000,000; celery, $600,000; potatoes, $225,000, and hay, $3,600,000, are very profitable crops. Dairy products, including butter, at $1,500,000; cheese, $320,000, and eggs, $750,000, are important sources of revenue to the farmers.

IMPERIAL VALLEY

East of the mountains in southern California is an extensive desert country, much of it without water, but large areas can be reached by ditches from the Colorado River. The most notable district of the sort is in the Salton Desert, near the Mexican boundary. A few years ago this was a lonely and forbidding region, but now, by aid of irrigation from the Colorado River, it has several thriving settlements, with 100,000 people and 200,000 acres of cultivated land. That portion of it known as Imperial Valley has the greatest development, and with rich soil and semi-tropical climate phenomenal results have been obtained when water was applied. The overflow of the Colorado River in 1906 delayed progress somewhat, but there is no prospect of a recurrence of a disaster of this sort.

One of the best known products of this region is the canteloupe, of which the annual shipments are over 1,800 cars, bringing nearly a million dollars. This valley contains over 400,000 acres of land, and just across the Mexican line are 200,000 more.

SALT RIVER VALLEY

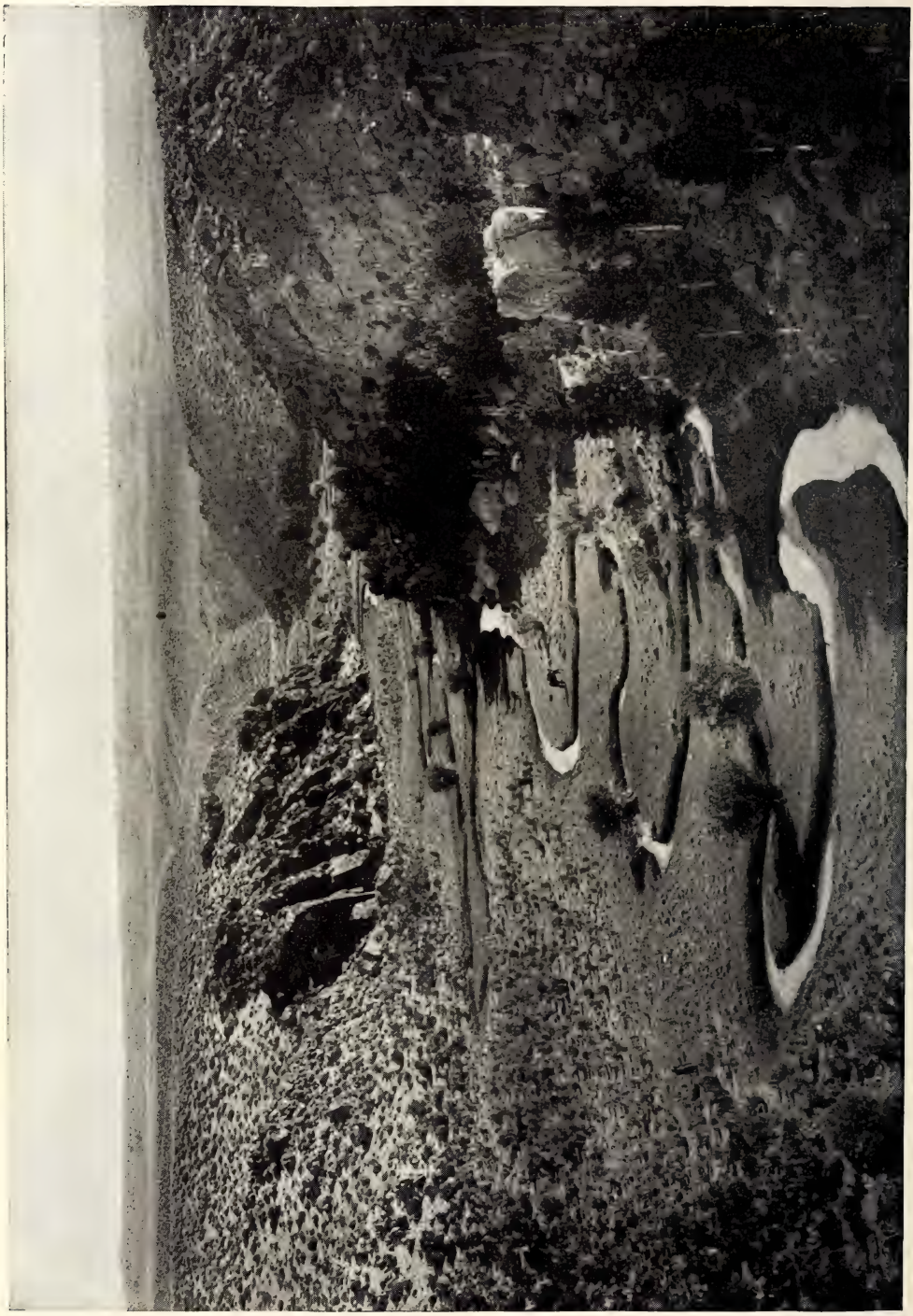
Salt River Valley is the "promised land" of Arizona. It is a very broad, level valley, extending east and west near Phœnix, and lying along both sides of Salt River, a stream which has a large watershed in the mountains of eastern Arizona. The valley is 50 miles long by 15 miles wide, and contains about one-half million acres of very fertile land, of which some 50,000 acres are now under cultivation by canals and pumping.

Normally the valley is a desert, for the rainfall is only from 6 to 7 inches a year, but the river water has been used for irrigation to some extent, and many wells afford supplies for irrigation of small areas. When the great Tonto reservoir is filled there will be sufficient water for 200,000 acres, and cheap power to run pumps to utilize the underground waters more fully for irrigation of an additional area of about 50,000 acres.

The dam across Salt River, erected by the Reclamation Service at Roosevelt for the Tonto reservoir, is 280 feet high, 1,080 feet long on top, with a total contents of 300,000 square yards. It required over 240,000 barrels of Portland cement, which was manufactured by the Government on the dam site. The reservoir, with an area of 25 square miles and a capacity of 284,000 acre feet, is the largest artificial lake in the world. Forty miles below is a diversion dam by which the water is taken out into great canals on both sides of the river that convey it to the valley lands, 15 to 30 miles below. These works will afford a large flow at times, when the water is needed for irrigation. The reclaimed land will cost the settler only about $30 an acre.

The principal product of Salt River Valley is alfalfa, but considerable grain, fruits, and vegetables are also raised. Alfalfa is cut from four to five times a year, with yield of four to six tons an acre, and it sells, baled, for from $8 to $12 a ton. Wheat yields 30 to 40 bushels to the acre.

Sugar beets have been tried in recent years with most satisfactory results, and



CROOKED CREEK, LONG VALLEY, CALIFORNIA: FLOWS IN A FLAT-BOTTOMED CANYON CUT IN THE WIDE DESERT PLAIN

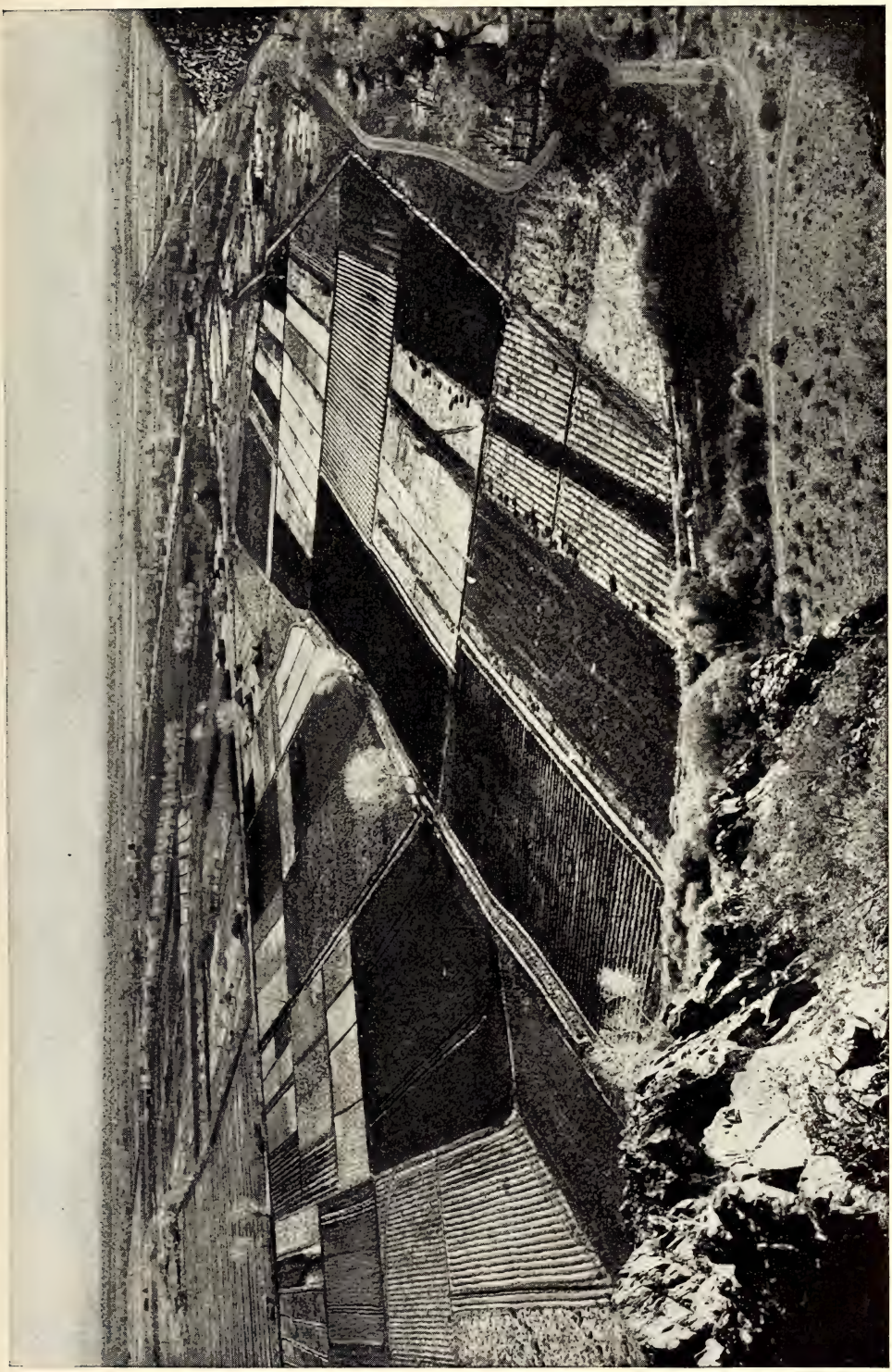


Photo by W. T. Lee

SALT RIVER VALLEY, SOUTH OF PHŒNIX, ARIZONA, SHOWING INTENSIFIED FARMING BY IRRIGATION

TYPICAL ARTESIAN WELL AT ROSWELL, NEW MEXICO

There are hundreds of these wells supplying water for irrigation (see page 657)

40,000 acres of them were planted in 1908, with yield of over 20 tons to the acre. A factory has been erected at Glendale by a Colorado firm, which has a million dollars invested in the industry. The sugar averaged 16 per cent, and a two-months' run of the factory yielded 6,000,000 pounds of sugar.

Choice canteloupes are being raised in increasing number, and in 1908 125 cars were shipped East and West to a ready market. Olives and dates are being produced, and of late the orange business has begun to thrive rapidly, because the fruit can be raised to reach the markets in November and early in December, so that it commands extra high prices. One hundred carloads went East in 1907 at $5 to $8.50 a box, which yielded a profit of $500 to $800 an acre. All the garden products are raised profitably.

I know of one patch of strawberries near Tucson which returned $1,000 an acre net, and many yield $500 to the acre. Sweet potatoes are raised with returns of $300 per acre. Cotton has proven a success in southern Arizona, and it is remarkable in having fiber so long that special gins have to be made for it.

YUMA REGION

Yuma, in southwestern Arizona, is situated in the low-lying delta region of the lower course of the Colorado River, with its wide stretches of fertile soil and warm climate. The yearly rainfall averages less than 3 inches, but the waters of the great river are available for irrigation, and the operations of the Reclamation Service will furnish a water supply for 79,000 acres. The principal work has been the great Laguna dam built across the river, 4,780 feet long and 19 feet high, to create a reservoir of 10 square miles, with a capacity of 26,650 acre feet and an annual discharge of 11,000,000 acre feet.

The agricultural capabilities of this region are wonderful, for the soil is rich and the climate warm. A great variety of crops has been introduced, from dates to cabbage, and the returns have been phenomenal.

There are many private irrigation projects in various valleys of Arizona, and the next few years will witness the reclamation of a large acreage of land ready for the settler. It is probable that in time all this land will be under cultivation, and central and southern Arizona will be a great producer of useful crops.

NEW MEXICO AGRICULTURE

Irrigation has been practised for many years in New Mexico, but until lately the product was not large and it was consumed at home. In the past few years operations have been extended greatly in all parts of the country, and now the value of the crops exceeds $25,000,000 a year. Alfalfa for feed is the largest product, but there is a variety of other crops from apples to cotton (see page 655), and in Messilla Valley 4,000 acres of rich bottom lands are affording a highly profitable yield of canteloupes.

The principal water supply is in the Rio Grande, the great floods in which go to waste, but recently work has been begun by the U. S. Reclamation Service on a dam near Engle, to be 265 feet high, to hold the river and create a reservoir 45 miles long to store over 2,000,000 acre feet of water. This water will be largely used in the southern part of the territory, besides furnishing 60,000 acre feet in Mexico. Two other smaller projects in the Pecos Valley will supply water to irrigate rich bottom lands. In 1908 permits were issued for irrigation of 654,500 acres in New Mexico.

In Chaves and Eddy Counties, in the famous Pecos Valley, there is an artesian area with about 700 vigorous wells, some of which yield 200 gallons a minute. The water is nearly all used for irrigation, and some wells irrigate 200 acres or more. The celery at Roswell, which has become celebrated all over the Southwest, is raised in this way.

Dry farming has also been practised to some extent in New Mexico with very satisfactory results when the soil was kept in proper condition, but unfortunately most dry farming is simply taking chances of having sufficient rain to raise a poorly tilled crop.

STOCK

Stock raising has always been a most important source of income in the Southwest, especially sheep, which range in vast flocks through many portions of southern California, Arizona, and New Mexico. In 1908-1909 New Mexico, with about 4,200,000 head of sheep, exported 700,800 head and had a wool clip of 18,000,000 pounds at 16 to 22 cents a pound.

Arizona estimates her sheep at 1,250,000 head. The first sheep, except those in the Navajo herds, were swum across the Colorado River at Needles, in 1876, at the time of the great drought in southern California. It costs about $1 a head a year to keep and feed them, and they pay 100 per cent profit under favorable conditions. The estimate of cattle in Arizona in 1907 was 342,837 head, valued at $3,753,406.

OSTRICH

The production of ostrich feathers has long been an important industry in southern California, and of late Arizona has gone into the business with most gratifying success. The beginning was made in 1885, with an importation of a few birds from California, and the increase has been such that in 1908 nearly 2,000 chicks were hatched. The birds, which now number 2,000, are in Salt River Valley, near Phœnix, where they appear to thrive as well as in their native country.

The birds are plucked every eight months, and the full-grown birds yield a pound of feathers to the plucking, worth about $25. The annual cost of keeping is about $10 a bird. Alfalfa is the principal food. One acre of good stand will support about five full-grown birds. The ostrich needs care when first hatched, but soon becomes very hardy. He matures in four years and is very long-lived. The plucking of the ostrich is done after placing the bird in a small enclosure and covering his head with a hood like a stocking. The picker then raises the wings and carefully clips off the mature feathers. The operation is entirely painless, but care must be taken to remove the dead stumps a couple of months later.

MINERAL RESOURCES

The principal ores of the Southwest are copper, and in the production of this metal Arizona leads the world.

The copper mines of Arizona have had marvelously large production, and while much very rich ore has been mined the deeper workings reveal an almost inexhaustible supply of ore, which will yield good profit unless the price of copper tumbles much below its present low stage. Copper constitutes about 90 per cent of the $42,249,281 aggregate value of mineral products from the territory in 1908.

The largest mines are at Bisbee, Globe, and Morenci, in the eastern part of the territory, and at Jerome, in the central part. There are numerous small mines and new deposits are reported occasionally. The total production for 1908 was 291,584,080 pounds, valued at over $35,000,000. Of this the Bisbee district produced about 40 per cent, the Clifton-Morenci district 27 per cent, Globe 12½ per cent, and Jerome 12½ per cent, approximately. The United Verde mine at Jerome is reported to have paid dividends of $22,270,322 up to 1907. The extent of some of the copper mines is indicated by the fact that in the Copper Queen mine at Bisbee there are 150 miles of rails. Considerable gold is produced in Arizona, amounting to 136,059 ounces in 1908, valued at nearly $3,000,000; silver, 2,571,698 ounces; lead, 2,995,183 pounds, and zinc 2,457,099 pounds.

New Mexico has large mining interests in gold, silver, and copper, there being 134 mines working in 1908, with total output of $1,529,091, of which copper was $806,867, silver $214,673, and gold $298,757.

New Mexico has very extensive deposits of coal. In the year 1908-1909 the coal mines yielded over 3,000,000 tons, having a value of $3,881,508, including

A BRANCH OF MALAGA GRAPES RAISED BY IRRIGATION IN PECOS VALLEY, NEW MEXICO

INTERIOR OF ORANGE PACKING PLANT AT REDLANDS, CALIFORNIA
The oranges are carefully graded and wrapped in tissue paper by machinery

MARENGO AVENUE, PASADENA, ONE OF THE FINEST RESIDENT STREETS, SHADED BY GIANT PEPPER TREES

A ROSE-EMBOWERED HOUSE AT REDLANDS, CALIFORNIA

Photo by W. C. Mendenhall

ORANGE GROVES OF REDLANDS REGION, CALIFORNIA, WITH SAN BERNARDINO MOUNTAINS IN BACKGROUND, ON WHICH SNOW REMAINS UNTIL SUMMER

coke, into which about 12 per cent of the coal is converted.

The U. S. Geological Survey estimates that there are 165,000,000,000 tons of coal available in New Mexico. In the Hopi Indian reservation, in northeastern Arizona, there is an undeveloped coal field of 2,500 square miles containing an enormous tonnage of coal. It is 75 miles from the railroad.

The great oil fields of California are in the southern part of the state, and with rapidly increasing production they promise to be the largest producers in the country. The output in the past year is estimated to have had a value of $43,000,000 or more than the gold production of the state, and nearly 10 per cent of it is produced in Los Angeles.

One well recently sunk near Bakersfield struck oil at about 2,300 feet, and the flow was so powerful that it at once became unmanageable. The oil spouted out at the rate of about 25,000 barrels a day, but fortunately it could be held in a great pool, while powerful pumps have since kept forcing it into a pipe line by which it can be shipped. Up to May 3 it had produced 2,000,000 barrels of oil. The oil sells at 50 to 90 cents a barrel, and is extensively used for fuel, as coal is expensive, and five barrels of oil have approximately the heat value of a ton of coal.

The oil occurs in some unexpected places; one of the extensive fields is at Santa Maria, in the midst of the old mission grounds, while in part of Los Angeles there are hundreds of derricks among the houses, and at Summerville many wells are in the water along the shore.

Excepting its great oil fields, southern California has not been a large producer of minerals. Several gold mines in the desert region have an aggregate output of about $200,000 a year, and this, with various ores, granite, cement plants, and brick yards yield a total of about two million dollars. This is not including the borax, which comes mainly from southern California, with a production of 50,000 tons, valued at about $1,000,000. Formerly, much of this material was transported many miles over the desert by the much-advertised 20-mule team, but now the railroads cross the country, and the energy of the mules is directed into other channels.

POPULATION

The rapid development of southern California in the last twenty years has been phenomenal. It has resulted largely from the disposition of Eastern people to migrate to a region which afforded the climatic advantages favorable to health and agricultural opportunities, especially in the very lucrative business of raising oranges and other fruits.

Los Angeles, the metropolis of the region, has grown rapidly and taken a prominent rank among the cities of this country, with a rate of growth second only to that of Seattle. It is a city of large business interests, and has many thousand comfortable homes, some of them palatial. In 1846 it had a population of only 1,200, in 1880 of 11,183, in 1893 of 75,000, while in 1908 it had increased to 300,000, and this high rate of increase continues. That the city has the characteristic optimism of the West is shown by a recent bond issue of $23,000,000 for a water supply to be brought from Owens River, over 200 miles, with volume enough for a population of 5,000,000.

The population of southern California is mostly American, as is well illustrated in the registry of the last election in Los Angeles, when it was found that out of 33,000 voters 5,000 were born in New York, 4,500 in Ohio, 4,000 in Illinois, 3,000 in Pennsylvania, 2,000 in Iowa, 2,000 in Missouri, and only 5,000 in California. Of the foreigners, who are only in small proportion, Germany furnished 2,000.

The assessed valuation of Los Angeles County is $585,000,000. The city is 22 miles from the nearest harbor of San Pedro, but it transacts a large and rapidly growing foreign and coast trade. More than $1,000,000 has been spent on this harbor, in addition to a $3,000,000 sea wall.

The population of the inland portion of the Southwest is very small, and there are many districts in which there is not one white man to 500 square miles. According to estimates by the governor, Arizona had a population of about 200,000 in 1908, and New Mexico was estimated at 450,000 for the same year. The area of these two territories is about 235,600 square miles. A very large proportion of the population is American born, but many immigrants are now coming in.

Considerably less than half of the New Mexico population is classed as Mexican, and there is a small proportion of persons of Mexican origin in Arizona and California. The principal cities are Phœnix, the capital of Arizona, with a population of about 15,000, and Tucson, Arizona, and Albuquerque and Santa Fé, New Mexico, which are approaching the 10,000 mark.

Pasadena, Riverside, and Redlands are thriving cities, with rapidly increasing population, largely of persons from the East who prefer California, especially in winter. Pasadena is well named "the city of flowers," for it is filled with them. Riverside and Redlands, and a host of smaller places in the orange country, have hundreds of handsome homes, miles of fine avenues lined with splendid trees, and many beautiful environments. All the cities of southern California are growing rapidly, and San Diego, with her excellent natural harbor, has attained a population of 40,000.

PUBLIC LAND

The amount of public land available in the Southwest is greater than in any other portion of equal size in the West. Owing to widespread desert conditions, limited water supply, and rough surface, however, only a moderate proportion is suitable for immediate use.

Nearly all of southern California east of the mountains is open for settlement, but in the fruit region on the coast side all the valley lands have been taken.

Arizona has about 40 million acres of public lands, and New Mexico about the same amount. In the latter territory, in 1906 to 1909, nearly 4 million acres were homesteaded and over one million taken under the desert-land act. Four-fifths of the homesteaders were from other parts of the United States. It is claimed that in New Mexico there are 13 million acres left which are suitable for dry farming and 2 millions capable of irrigation. In Arizona only about 7 per cent of the land has been taken up, and only about 20 per cent of this is under cultivation.

A LAND OF ETERNAL WARRING

By Sir Wilfrid T. Grenfell

Author of "Labrador: The Country and the People," "Vikings of Today," etc.

EARLY descriptions of Labrador are not encouraging, even though its discoverer, the Viking Biarni, son of Heijalf, came from Iceland, and was naturally prejudiced in favor of a country at least more favored than his own. He did the best he could for it, calling it "Wineland," on the principle that Erik had christened Greenland, visibly that "it might draw men thither if the land had a good name."

But Thorwall, the poet of the expedition, has left on record his most unfavorable impressions, which it may be as well to quote:

> People told me when I came
> Hither all would be so fine;
> This good wineland known to fame,
> Rich in fruits and choicest wine,

Now the water pail they send;
To the fountain I must bend,
Nor from out this land divine
Have I quaffed one drop of wine.

and later,

Let our trusty band
Haste to Fatherland,
Let our vessel brave
Plough the angry wave,
While those few who love
Wineland here may rove
Or, with idle toil
Fetid whales may boil.

Many years of Labrador life have left in my mind at least one indelible impression. It was created the first day I set eyes on its rocky coast. It was under a cold, sullen sky, from the icy bosom of the polar current that swathes it, as we caught a glimpse of a low, naked line of headlands and small, barren islands, over some of which the heavy Atlantic swell was making every now and again a clean breach, while here and there great ominous "sea horses" raised their gigantic heads, as they charged furiously over uncharted reefs, which themselves neither gave quarter to nor expected it from anything.

Truly, it is a land of eternal warring. Everywhere along its coast-line great seas ceaselessly pound as with the hammer of Thor into its adamantine sides. The almost resistless arctic ice-flow growls and groans as it crushes, cleaves, and smashes the very face of nature, while the monster bergs outside, like ominous ice giants, roar and crash as they vainly battle with their still more resistless enemy, the summer sun.

Where in the more sheltered spots gentler nature strives to spread a covering over the nakedness of the land, abysmal cold wages battles with the tenacious plants and scrubs, which grow gnarled and knotty in the conflict. The few animals that in any number can survive in its wilds, are especially endowed to resist its apparently never discouraged efforts to destroy the very source of life.

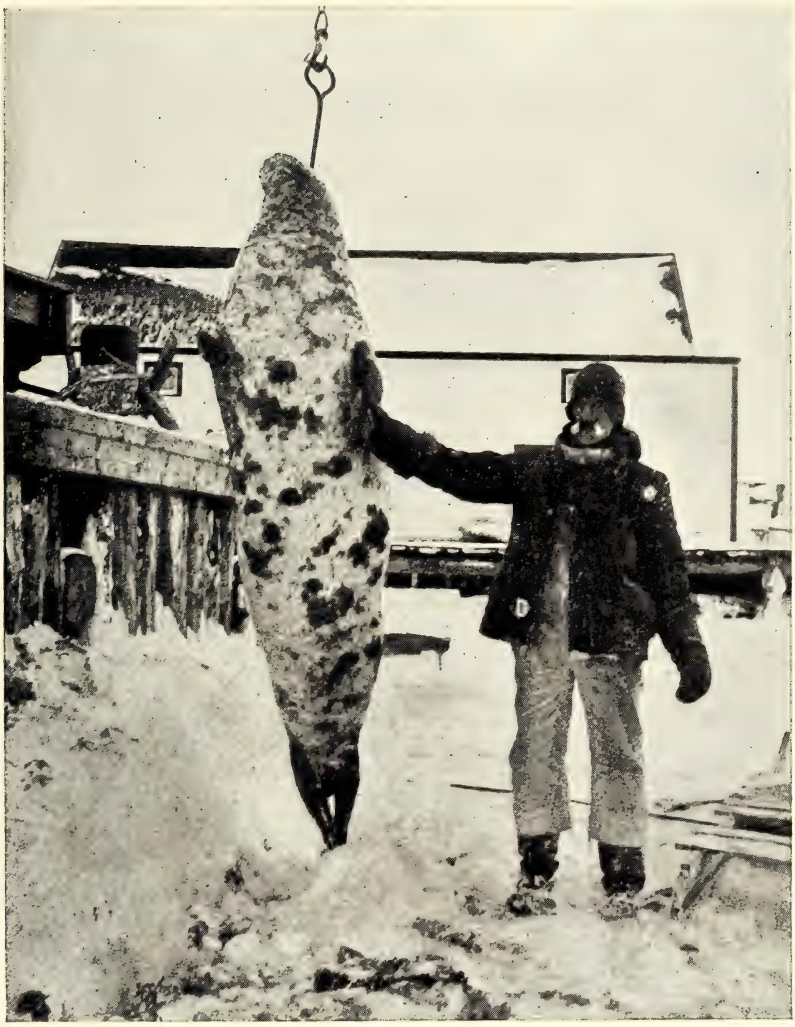
Cradled in its rocky fastnesses, resistless storms sweep madly its already almost denuded bed rocks with a generous abandonment, as if the chance of effecting destruction justified any outlay of energy imaginable. It is a land well suited for the location of the traditional wicked man, as little likely to afford him any dangerous liability to peace.

As one approaches it from the Atlantic and passes its high portals, the cliffs of Belle Isle, the traveler spies a stout log house perched high up on a barren ledge clinging to the very face of the cliff. Suggestive sight: it contains cached the necessities of life against the inevitable day when some poor voyagers shall find themselves suddenly dependent on its savage clemency. Meanwhile, the thoughts of those who know fly to the poor creatures from the "Dainty Lady," the liner *Scotsman,* which, laden with Christmas cheer, late one fall received the hospitality of its eastern ledges, and now lies a scrap heap in her deep-water graves close by. One sees, meanwhile, visions of women dying in their tracks as they painfully struggle toward the western end for shelter. Sometimes one seems in its storms almost to hear their screams of joy over just such victories.

Viewed, as those who frequent it mostly view it, from the sea, one would think its sole harvest was the countless ice-borne erratics that crowd every hillside and crown every sky-line, just where other countries would be flaunting flowers, fruits, and trees.

Still there remains in my memory, after all this lapse of years, the intense curiosity I then felt to learn what kind of human beings such an environment had evolved. Since then I have learned that in the realms of human life also the same stern conditions maintain. Life is truly a battle in Labrador, and its conditions are responsible for a white race as remarkable for their adaptability to live under the very hardest of physical conditions as the native Eskimo they are steadily replacing. These little arctic natives can withstand anything except civilized man.

But Labrador, beyond being a place of war, is a land of contrasts—a land where extremes meet—and where no man dieth



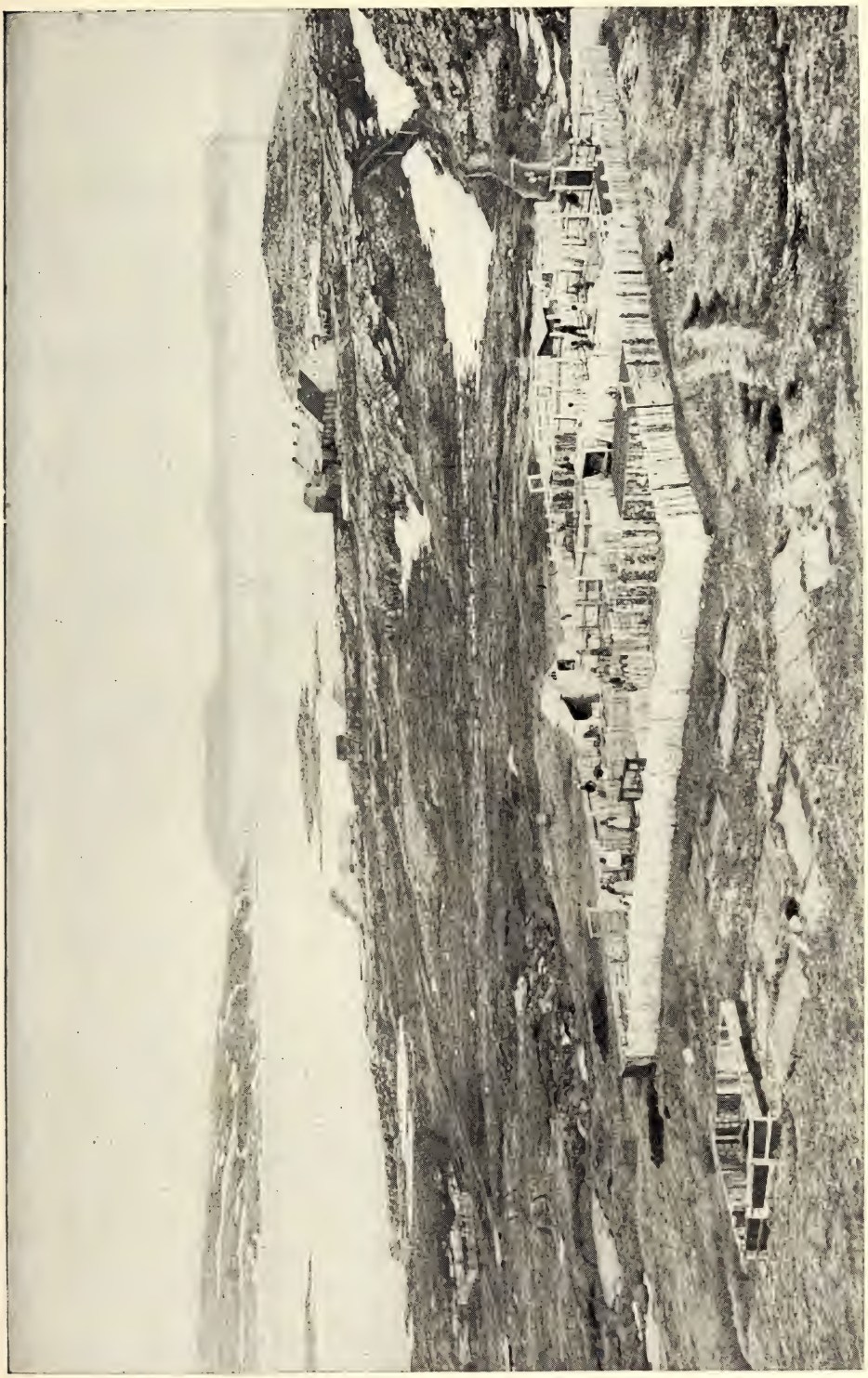
HAULING UP AN OLD HARP SEAL IN WINTER ON THE WHARF

We eat these and feed dogs on them, and sell the skin and fat

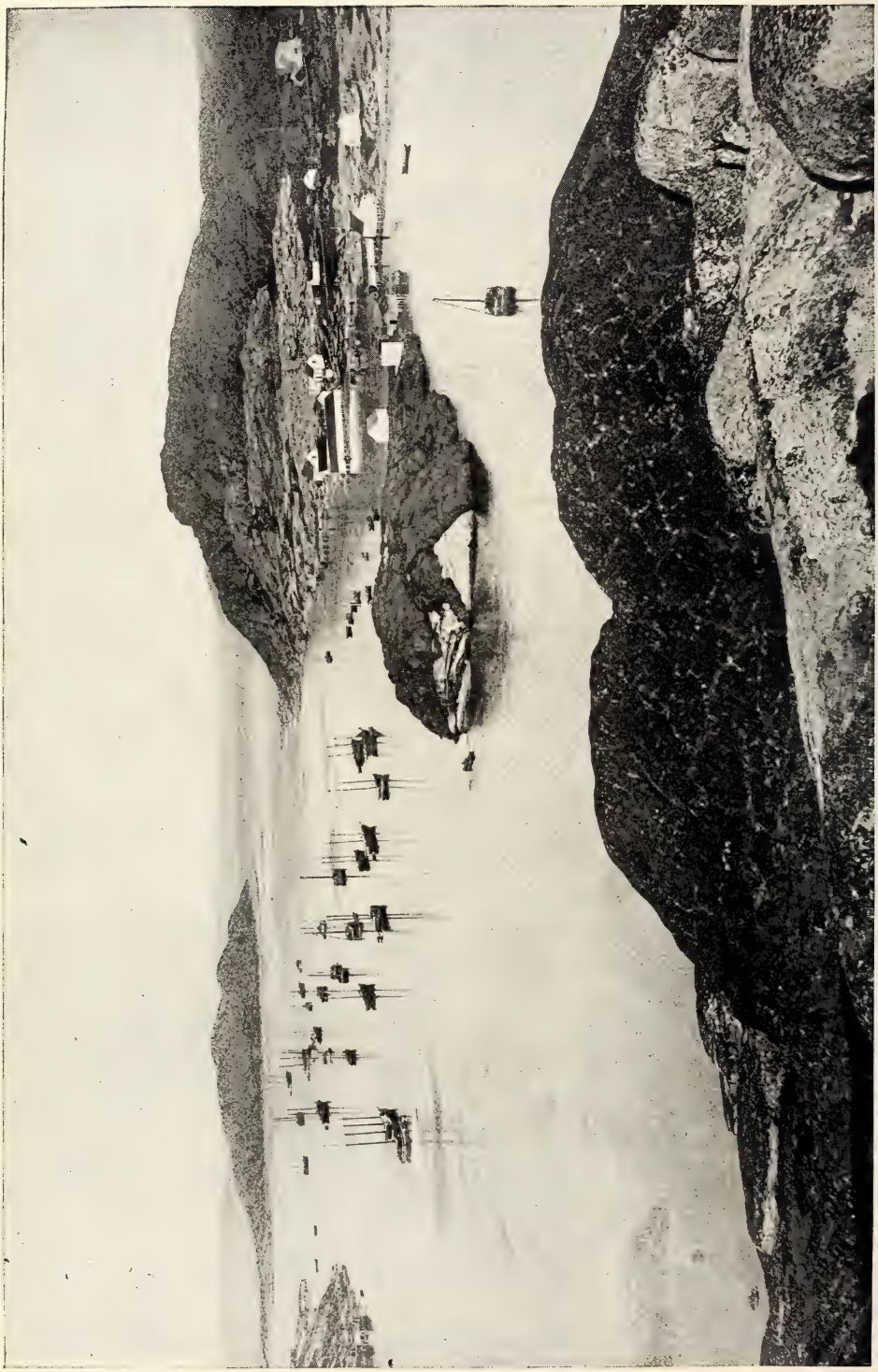
from monotony of physical circumstances. Scarcely a stone's throw from this ceaseless strife one finds oneself in a land almost of oppressive silence—a country so utterly devoid of the busy hum of human life that the dominant idea forced upon one is, "Can I be certain I shall ever again get back to the haunts of men?" while visions of the uncertain opportunities for communication with the world outside rise unbidden to the mind.

Soon, however, memories of its generous spaces, its glorious fiords, its keen, bracing air, its call for resourcefulness, its rich sea harvest, its noble rivers and plenteous salmon, its wily, silent animals with their priceless skins, its countless deer herds come back to cheer one. Its splendid evergreens, its gorgeous mosses, the carpet bedding of its brilliant lichens all serve to relieve the first chill of its barrenness. Add to these its beauteous nights, its long twilights, the fantastic

A BREAKING SEA ON THE ROCKS



HEBRON, LABRADOR, SHOWING MORAVIAN STATION
This mission from Moravia was founded by Zinzendorf in 1770. It has six stations



INDIAN HARBOR—OUR HOSPITAL,—A LABRADOR FLEET HARBORING—MOUTH OF HAMILTON INLET
Peary's first place of call from the north, and the most northern wireless station

colors of the moon shining on its weird ice and deep blue seas, the unearthly loveliness of its auroras, and the magnificent tracery of its northern cliffs. Such a land is it of changes and of contrasts that those who love it at least may be forgiven for thinking it the borders of fairyland.

It is indeed a fine set of people it has produced, for we count as Labradorians the thousands of men and women from Newfoundland who every year come to wrest a living from its reluctant grasp.

I was watching one day from our decks a fleet of what seemed such tiny schooners to be battling with the circumstances of Labrador, as to suggest foolhardiness on the part of those who handled them or indifference, except to gain, on the part of those who owned them. A number of boats had come alongside, bringing patients or visitors from most of them. Some comment made as to their size was half heard by a woman from one of the schooners, and she turned and told me about it.

Apparently it was "her venture." Her husband and three sons had been forced to fish home, "having no boat large enough to carry them to the Larbardore." She had stimulated them to put their all into this small 20-ton vessel. They had been unable to pay a crew, so she not only let all her boys go, but went herself, and to fill up the complement persuaded her eldest boy's young wife to join them also. No wonder the vessel loomed up large in her eyes, for now all the earnings of the "ship" would be kept in the family.

Sea love, self-reliance, and optimism are the three strongest traits of character developed in our people, with rather more than the ordinary amount of fatalism.

There is no doubt the people are tough—tough as their own sharks, they say, which will come to a bait made of their own liver, or continue to eat after being disemboweled. Anyhow, the latter are so unemotional, that I have gaffed three with a boat-hook prodded into their heads as they swam on the surface in the same pool, and then hauled them out to freeze ignominiously on the floating ice.

I have lain shivering in my bag on the floor of a house, when the youngsters have been curled up in a heap with "ne'er a covering," and snoring enough to shake the rafters. (A great many suffer with adenoids.) I have tried to allure them to drink cocoa and milk on a cold morning, and seen them pour it surreptitiously outside the door as being "too full o' sweetness," and heard a man say and mean it, "you give me a lassie duff in the morning and that'll last me all the day."

I have seen our postman start off in winter on his fifty-mile tramp with nothing but a piece of dry, hard bread in his pocket, and this he has been doing these past forty years.

I have known a woman (with now ten children) put off laying up for her confinement till she had to run from the wash-tub, leaving her husband's overalls unwrung, and be up and wring them herself three days later. She was at the time living on dry flour, and not once a week getting enough of that. She had no bed clothes at all, and she told me her leaky house has prevented her turning over in bed because her dress was frozen to the wall. Herself and children are now my flourishing neighbors. She never had a day's real illness till ten days ago, when she came into the hospital and had her appendix removed.

In my mind there is no doubt, however, that Labrador can maintain a good population, but at present no capital has been invested there except in the fishery and furring. Neither of these industries do practically anything to enrich the country, seeing that almost every fish caught and every fur killed leaves the coast as it is, and is turned into money elsewhere.

Cod, salmon, and trout are exploited rather than fished. Rivers have been barred with nets for years. The indiscriminate use of cod traps with small mesh leaders destroy every year thousands of salmon-peal seeking the rivers, and, in the opinion of every one, injure

LABRADOR FISHING SCHOONER, BLOWN UP HIGH AND DRY AFTER A BIG GALE

These storms are rare in Labrador; a really bad gale doing damage of any extent to craft is quite infrequent

very seriously the cod fishery itself by almost entirely preventing the great shoals coming inshore to feed. No means are taken to recuperate this fishery. There exists no fish hatchery, and no scientific use of deep-sea thermometers. Only a very few use preserved bait, and there is no bait-freezer on the coast, and no cold storage to carry away fish fresh to market.

As yet the putting up of fresh codfish in tins has not been successful in the markets because not backed by capital and advertisement. We used the past winter side by side the fresh fish frozen and some excellent tinned cod put up by an enterprising firm from Fogo, Newfoundland, and as yet at least no one has been able to tell which fish they were eating. What has happened to our mackerel and our marvelous herring I do not know; all I am able to state, no scientific efforts have been made to find out.

The survey of the coast is so ancient and so unreliable that we have devoted considerable time to making charts of our own, in which efforts I have during two summers been helped by his excellency Sir William MacGregor, the former Governor of Newfoundland.

Till quite recently not a single lighthouse served to help the numberless craft plying their calling on the coast, and still today not a single harbor has a light or has in any way been artificially improved.

I remember well when the only light

MY LEADING ESKIMO DOG, "CÆSAR": BATTLE HARBOR, LABRADOR

on the coast was from the north window of a tiny building put up by pious hands for religious services in summer. In this two large kerosene lamps used to be swung round to face the north windows every dark night in the fall of the year, to be a literal guide to the poor schooners trying to make a safe anchorage on a very dangerous part of the coast. Once because this light was out I had to steam to my anchors for 24 hours to save the ship, while all of seven schooners anchored near were driven on the rocks.

For our own consumption we still get plenty of herring, and they are the largest, fattest, and sweetest in the world. As an old resident of Yarmouth, England, one should know something about herring as an article of diet.

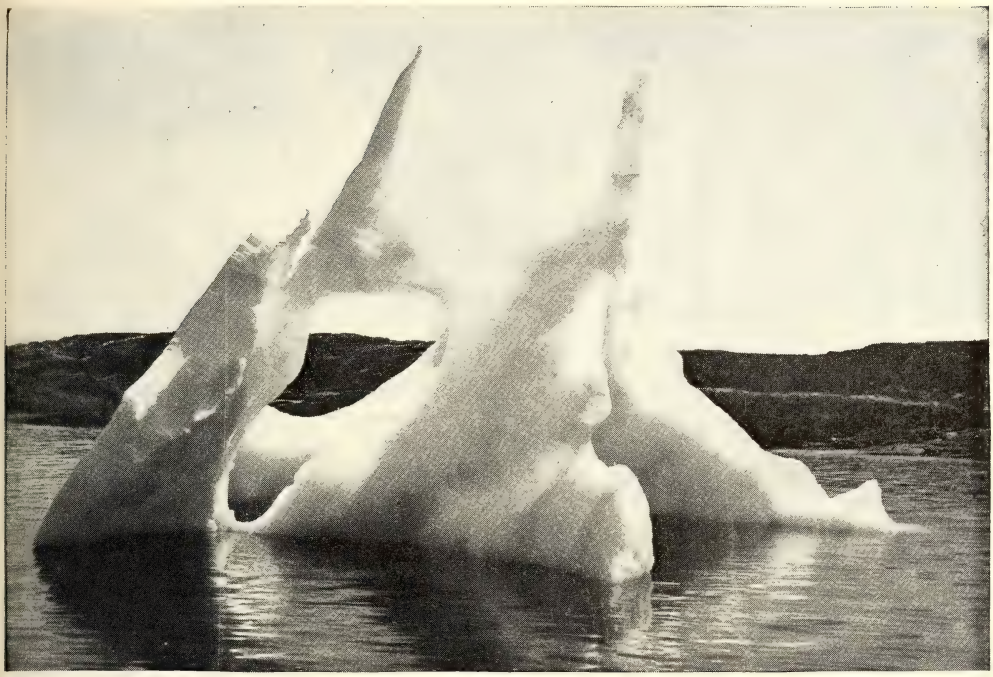
Practically no use is made of the billions of capelin that can be bailed out of the sea with a dip net. That they could be preserved profitably there is no question.

The other sea denizens of value that are exploited at present are whales and seals. The former are not in any great abundance, and the factories do not return more than the outlay that such a speculative business calls for. The hump is the commonest of our whales, a smaller animal than the rest, and not nearly so valuable as the larger sulphur-bottom, or the occasional sperm that strays into our waters.

From 50 to 100 whales is a paying season, and as with the hogs at Chicago there is very little wasted, even the

LABRADOR SCHOONERS IN MAY IN SAINT JOHN'S HARBOR

They come there to get their outfit of flour, molasses, pork, tea, and salt for curing fish. These "pans" of ice are called "Growlers," and are the remnants of the Arctic floe



A WEIRD PIECE OF ICE IN BATTLE HARBOR

blood being collected and turned into fertilizer with the bones. The products of the ductless glands, which as the creature is a mammal should be really valuable, have never yet been extracted. The University of Kansas, through its enterprising industrial chemistry department, is anticipating work on these from the pineal gland to the suprarenal capsule next year.

Whales seem to depend for safety more on their ears than anything, their eyes being of little value. Indeed the eye with all our animals except birds is least relied on. A fox will jump into the arms of a man on an open marsh if he keep still and is down wind. A stag will run right up to a man, who stands without moving in the lead it is traveling. I have seen a stag charge down on a man with a head and horns of a lately killed deer placed over his head and shoulders, the stag not noticing he had only two legs.

But birds are the reverse. Ear and nose count for nothing compared with the eye of our hawks, gulls, and even less wary birds. Ducks do fail more signally to tell things that are dangerous by sight, but it seems to be obtuseness in the process of their cerebration and not keenness in recognizing. Like many men they don't act quickly enough.

A strange mistake in instinct our migrating ducks always make when it is foggy. They never seem to escape it. They come south along the coast for full 600 miles, flying close to the headlands. When they have gone 580 miles they pass Cape St. Lewis, and a wide, deep bay opens up with only the narrow south side of the bay between them, and the Straits up which nearly all the ducks are bound. As sure as ever a northeast wind blows, and there is too much fog to see across the inlet, practically every single flock will turn up the bay evidently mistaking it for the Straits. They are unwilling to rise and cross the land, I presume for fear of losing their bearings, so they follow the shore right

THE SUMMER HOUSE OF A FISHERMAN IN LABRADOR MADE OF TURF AND SODS

These houses are abandoned to their fate and allowed to fill with snow and ice; the people just clear this out and use it again next year. It gets welded together. White shells are used on the floor. These particular men own no schooner of their own to fish from, so take passage on a friend's and fish in small boats from the land.

SMALL SCHOONER PUSHING "DOWN NORTH"

The iceberg and the floe-ice show the dangers and the fearlessness of the men. These vessels are only 2½-inch planking, and every year some are sunk by the ice going through their sides. It is remarkable how few lives are lost, however. The pieces free are used as rafts till another vessel comes to the rescue.

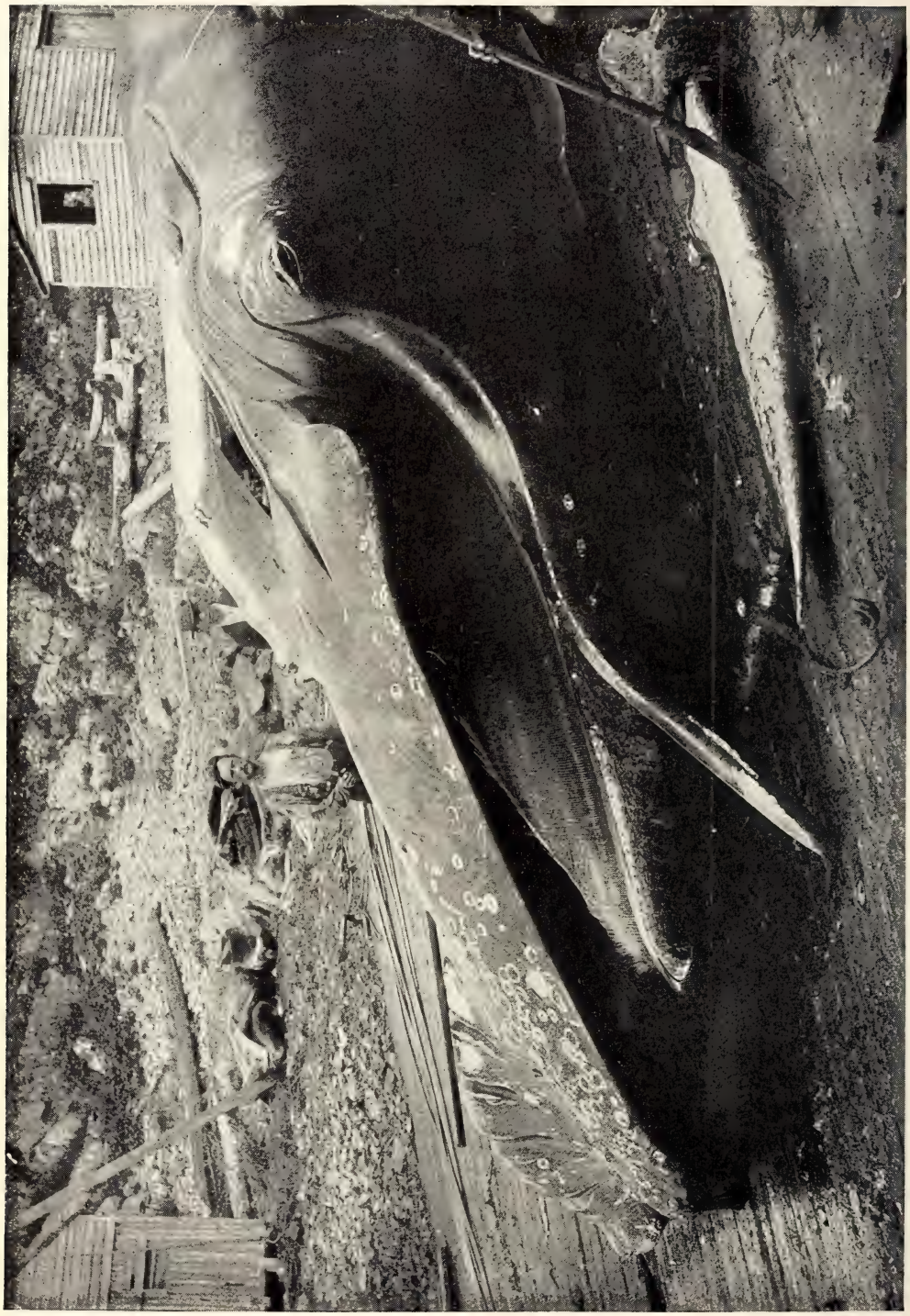
around, passing between some islands and the southern cape.

So regularly is this the case that every northeast wind in the fall, without exception, a crowd of gunners line this tickle or strip of water between island and mainland, fire at random into the passing birds, and share equally the victims that fall. It is worth any one's while to join this company once, if only to see the arquebusses and almost "culverins" that some of these men produce and fire out of.

Their dogs, too, are a wonderful sight retrieving in these breaking seas, and climbing back against the back wash up these smooth-worn cliff sides. Only native dogs can stand it. My English retriever and spaniels are forced to confine their attention to the little piles of birds that soon grow up behind each sportsman, which with skill worthy of a better cause they steal and bring to mine.

For home consumption, however, the seals are most valuable, their skins and fat forming a marketable commodity of no mean value. When seals "strike in" plentifully it is the easiest way in the world to get rich, for it means that this source of wealth just comes to your door and drown themselves in your nets ready for your use.

Certain headlands are far better than others for this purpose. These are situated generally close to great turns in the land, as if the seals under water steered by the coast exactly as the birds do above. The analogy is made closer by the stupid way so many trim into one or two wide blind bights near the corner,



HEAD OF A WHALE, SHOWING THE BIG BARNACLES THAT GROW ON THESE CREATURES, AND ALSO RELATIVE SIZE OF A MAN AND A WHALE'S JAWS

exactly as if they had lost their way, a good instance being L'Anse Amour Bay, behind Forteau light-house.

The other great way to catch seals is known as ice hunting, and means following the whelping herds out on to the drifting floe ice, which is done either in large vessels or with light punts hauled over the floe from the neighboring land, or simply by venturing out on a run and chancing getting back to land again.

Labrador seals are real seals, and not the fur-bearing "*Otaridæ*" of the Pacific. Our largest, the hoods, are of immense size and height, and by no means to be carelessly approached when with their young. They will then show fight very readily, and many a poor old bull has come by his death from a rifle just to enable the murderer to steal the pelt of his baby that he was defending, his own body being left, after all, as being too heavy to take.

Their strength is well shown by there being found in their stomachs shells that do not exist less than 90 fathoms down, at which depth they must withstand a pressure of eleven atmospheres, while puny man, with all his apparatus, has not been able to descend thirty fathoms. Specially provided for spring boot bottoms are the *Phocæ barbatæ,* or square flippers, their skin being very thick and water-tight, and almost hairless. Of any and all these the meat can be eaten, and the fat used for fire and light.

That a young seal can rival the fatted calf on his own ground is shown by the fact that a white coat, or Kotik, of 38 inches long will have an immodest waist of 34 inches round.

Excellent as their skins are always for sleeping bags, canoes, tents, harnesses, etc., for clothing, in cold weather they cannot touch the cured caribou hide. In mild weather the seal hides are, as might be expected, much more water-tight, except when tanned, which we do by letting the skin "tint" till the hairs can be scraped off, and then soaking them in the boiled bark of our fir trees.

The soft chamois-like, cleaned skin of the deer makes clothing impenetrable to wind and weather, while the gloves and moccasins, being soft and mobile, are far warmer than the Labrador seal. So important a point in keeping warm is this mobility of the boot that in really cold weather there is a perceptible difference between a doe-skin moccasin and one made of an old stag, the thinner doe-skin being much warmer.

These deer are in great abundance still, and are still a staple article of diet and clothing, and even tent covers, with all our northern folk. The softened skin is generally brought out by our Indians and sold by the pound. They also bring out what they call parchment—that is, skin with the fat left in and the hair removed. This is used for filling snow-shoes, and is often sold by them cut all ready into "babbage," and rolled up into balls like string. The winter skins of deer killed by Eskimo are invariably used as bed spreads, the close, thick hair forming the best insulator possible from the cold ground.

When old or superabundant, these are exported to Germany, where with true Teutonic economy they are used for station mats till the hair is all trodden off, after which they become white buckskin gloves for the immaculate guards of the German Emperor.

That these deer can obtain in such quantities in spite of their numberless enemies, human and otherwise, proves what an immense industry is possible in raising domestic reindeer for their meat and hides. I have just heard from a doctor friend in Alaska, whose herd of 70 in 1902 has become 490 in 1909. My own herd of 250 in 1907 has become nearly 600 in 1909.

Flies are, strangely enough, really the worst enemies of the deer. There may not appear a single fly mark on a deer one kills, and yet among many hundreds of skins I never yet saw one skin that has not from 100 to 1,000 holes in it bored by the grub of the hornet-like fly we call "stout," while it is safe to bet that you can never kill a caribou without finding eggs, chrysallides, or the maggots of these flies lying among the ethmoid cells,

The sealing industry is carried on in March and April, when the Arctic ice comes south in vast fields. On this the Harp and Hood seals whelp. The big steamers, 22 in number, force their way through it, collecting and killing the helpless young. This is the ship's crew hauling sealskins with fat on to their ship.

A SEALING CREW "PANNING SEALS"

In this case the seal pelts are all massed together. Flags denoting to what ship they belong are fixed up on the heap, and the ship endeavors to pick up all her "pans" as opportunity offers. Often she never finds them, and so much waste occurs many times; also another crew comes along, removes the flags and annexes the seals.

or soft bones, far up in the nose and right against the base of the skull.

Wolves in Labrador are not very plentiful, judging from the quantity of skins sold annually at the various fur-trading posts, but they are naturally the relentless foe of the reindeer, whom they always follow till they kill. Of all the tragedies of life that appeal to me as pathetic in Labrador, none equals the wearing down of a gentle deer by these grim shadows of death. To know, as they must, that a wolf is on their track, and that there is no defense against him, no safety night or day, must be a prolonged nightmare besides which the pain of being torn to pieces alive by a hawk or eagle is an easy death.

A deer at bay, standing on his hind legs, makes an excellent fight with his enemy. Not only have trappers told me of scenes of this kind they have themselves witnessed, but I saw my own largest Eskimo dog twice knocked head over heels by one of our own tethered reindeer stags that the brute was endeavoring to kill.

Black wolves, or nearly black ones, are occasionally killed on our coast. I know of no one who ever saw a white one on our coast except the author of "Northern Trails." Among other animals of value, the black and silver fox rank easily first.

No fur can be said to have a standard value; the range is immense. Five years ago, on the coast, Patch foxes fetched as high as $30.00 apiece, and the best lynx skin only $3.50. Today the Patches are worth $8.00 to $10.00 at very best, while the lynx are worth $25.00 to $30.00. I have bought sables on the coast at $3.00, and a year or so later at $30.00. Today they are down again to about $10.00. The biggest range is naturally in black and silver foxes, which I have known fetch once on the coast $900.00. On the

ESKIMO GIRLS OF OKKAK, LABRADOR

CHARTING OF LABRADOR

Governor Sir Wm. MacGregor at the theodolite; Mr Gould, of Bowdoin University, acting secretary. This is some of our volunteer work

other hand, I have known a trapper paid $40.00 in trade (value about $20.00) for a fox which fetched $700.00, or £140, in the market.

I have tried breeding foxes for five years, but without success. My "parks" were close to the houses, and too much disturbed, I presume. But others have had good success, and I intend later to try again further in the country.

That black parents throw black pups is a fairly well-established fact, especially when the black parents are of the second generation. That black pups are sports of red parents, just as bitches have puppies of many hues, is also true. It is possible naturally for these black scions of red parents to throw back and have red pups. But with black grandfathers and mothers, the puppies are pretty certain to be black also. The feeding of these is no more difficult than that of any ordinary dog, and the offspring may be worth $1,000 apiece. Last year I saw dug out from an island four small foxes, all dark silvers. These had a black mother, but unfortunately the dog was not seen. I presume he also was dark.

Other writers to the contrary, foxes of the same brood will kill and eat each other. I have known it three or four times.

Of bears generally I have little to say. We have our share of black and white. Both of these I have shot and eaten. The flesh of both is good and nourishing. The black bear, being a herbivore, as a rule tastes much like venison. He is, however, exceedingly fond of fish, and he not only poaches salmon pools, but comes to his death from this predilection, for it leads him to wander in search of the innumerable dead capelin, and to venture almost into the summer fishing settlements.

Many interesting tales about bears nat-

THE PHYSICIAN'S DOG TEAM AWAITING HIS RETURN FROM A WAYSIDE CONSULTATION

DR SEYMOUR ARMSTRONG GOING ON A SICK CALL: LABRADOR

SENDING SOUTH FISHERMEN WHO HAVE DIED AT HOSPITAL

It is the custom to preserve the bodies in salt—when their own schooners call for them and carry them to their southern homes

urally exist on the coast. In the space at my command only one or two things, however, are worth noting. There can be little question that the polar bears, together with other animals, like caribou, and seals, and birds, possess a sense not inherent with men, viz: a direction sense. Whether it is magnetic or what, I do not know, but I am convinced it exists.

I have followed bear tracks for many miles, both along the coast and inland, and whether the course took him over flat snow fields, large lakes, through dense woods, or across wide arms of the sea, he always kept going steadily north. I refer now to stray bears that have followed the whelping seals too far south on the ice fields.

I met a polar bear once in the open Atlantic full three miles from the nearest land, just rolling lazily along north. If there were anything to be said for the evolutionary influences of natural selection, the polar bear should certainly be as amphibious as the seal in the near future.

But I must leave the animal resources of Labrador, and come to the vegetable wealth—a source of wealth that is by no means to be despised, as it is very easy to show. The red partridge berry or small cranberry, the blue hertz or bilberry, the yellow bake-apple or cloud-berry, the purple marsh-berry, with the red currant, the raspberry, and gooseberry, are all abundant, all easily preserved, and all grow without any effort on the part of the natives to sow, cultivate, or in any way improve them.

Sweep up a barrel full of the cranber-

THE FEW SHEEP HAVE TO BE SO CAREFULLY TENDED THAT THEY GET QUITE TAME

ries, and let them stand exactly as they are in a barrel, and they will be good all winter. Fill a barrel with the luscious bake-apples, pour in water and head up the barrel, and you have a delicious fruit all winter.

Nature, moreover, looks after you if you are too lazy to do this, and your children can run out in spring and pick cranberries and marsh-berries that have only sweetened for being under the snow all winter. The red of the cranberry is also a natural dye.

Of cultivated vegetables in Labrador the success depends on the shelter, natural or artificial, they get from summer frosts. In the bottoms of bays, carrots, peas, potatoes, lettuce, radishes, beets, etc., all grow in the open well.

Lord Strathcona developed a potato whose leaves crept on the ground instead of standing upright, and thus escaped these summer frosts. The Moravians gain the same end by covering the beds with rolls of brin or burlap, putting their potatoes to bed when they go themselves.

The leaves of our spruces make an excellent brew, when boiled with molasses and fermented, though the result is too intoxicating for an enemy of alcoholic beverages like myself.

There is no need whatever for the scurvy that so generally afflicts some of the families every spring, except their own carelessness and ignorance. Now we seldom, if ever, see it. Mushrooms, of the varieties Russulæ and Boleti, grow in great abundance. Those who know, eat them freely fresh in summer, and, threading them on cotton strings with a needle, suspend them in the house and let them dry for winter. They swell out, and taste as good as fresh.

This is a commercial rather than an æsthetic article, and sooner than describe our innumerable flora of the small but bright sub-arctic varieties, whose abundance is well attested to by the fact that we have no less than 14 varieties of *Potentilla,* I will say a word about other possible industries for the country, though while speaking of flowers I should mention that the coveted Alpine Edelweiss has been introduced near Hopedale, and can now be found growing wild in the neighborhood. The immense future that lies before pulping in this country is, I think, very evident from the success attending Lord Northcliffe's great venture in Newfoundland, and by the fact that every acre of sea and land from the Straits to Hudson Bay has been applied for ahead, if not granted, for this very purpose.

The incalculable energy of the countless falls, including the Grand Falls of the Hamilton River, probably the third largest in the world, and second only to the Victoria Falls in height, is an asset which the future will be unable to overestimate. Now that chemistry stands on the very verge of a synthesis of atoms, and a new world seems to lie at our feet if sufficient energy is procurable, these hitherto unappreciated riches are beginning to excite attention. I have had already inquiries as to the feasibility of bridling these falls for the purpose of collecting nitrogen from the air for fer-

PACKING WITH DEER IN SUMMER: LABRADOR

SOME OF OUR REINDEER

A BATCH OF MY LABRADOR ORPHANS

Open-air treatment for orphans

tilizing purposes. It is well known that the world supply of nitrates is giving out; that wood as fuel, and even coal are rapidly diminishing. Here lies one immense source of wealth that even the dull eye of a twentieth century scientist can foresee.

In our vast bogs lie supplies of peat that are almost inexhaustible; only these last few years has industrial chemistry turned its attention to these natural resources. All round this country the little settlements are bare and denuded of the beautiful evergreen trees given for their protection and for preserving animal life, just because of the ignorance of the heating material lying in the unused bogs, which instead of being injured would be improved by being used as a fuel supply.

The vast area of ledges, which run along our east coast, produces in places immense quantities of various seaweeds, which the storms pull up and fling at our doors without our having to stir a finger. In Norway the ashes of these weeds, just burnt on the beach, fetch from $2.25 to $3.75 a pound, and bring to the country as worked now $150,000 a year. Nature seems to make special provision for primeval-minded man, which as he increases in numbers is withdrawn, and so he is forced to put his wits to work and grow in stature whether he likes it or not.

In the spring, berries for us are ready under the snow, shell-fish in abundance under the harbor ice. Soon flat fish and round fish are veritably thrown on the beach, and can be dipped out with a hand net and can be speared with a straightened hook on a stick, or, as old Cartwright tells us, are at times so plentiful he could lie on the rocks and catch them by the tail in his hand. Trout we

"The man in the middle crossed the Straits of Belle Isle alone last winter, making three trips to and fro. He dragged a boat he built of canvas and laths, 7 feet 6 inches long, 2 feet 3 inches wide, and 13 inches deep. He had a little canvas cover, an oil stove, some food, and nearly 200 pounds of mails. He was out all one night in one of the worst gales we had, and drifted next day to land with his boat almost to pieces. He covered the bad parts of the laths with tin and went cheerfully on. He is a Labrador native, and his name is Ernest Doane."

can get in abundance through the ice all winter. Salmon and trout come walking into a net, only a few yards long, tied to your own wharf head.

Hares—well, I shot four in a couple of hours yesterday behind my house in this now growing settlement. Partridges—*i. e.,* willow grouse—well, my larder is stocked with them hanging from hooks that were shot last fall. I have known an Eskimo to kill 500 of these partridges by the simple process of flicking off their heads with his dog whip. Meanwhile there is another equally guileless and dainty variety, called spruce grouse, who sit on a bough while you go and slip a noose over their head, not requiring even the expense of ammunition.

I have not room here to write more of the native races that the white population are now displacing. Like all ignorant people of all races they are the cause of their own undoing. The indiscriminate cohabitation, and even marrying, is one serious factor in their downfall. Here are two cousins, each of which marries the other's daughter, so that each became the other's mother-in-law, sister-in-law, and cousin; and here, again, is another, who married his own son-in-law's daughter, so that she became, I presume, her own step-grandmother and her own father's mother-in-law.

Their lack of interest in sanitation or any health laws, and contempt for any prophylactic precautions, is simply phenomenal. I have taken away the clothing of a patient with typhoid and a high temperature to keep him in bed, and found him outside the house next day naked, while their passion for "something to rub" or "something that will

stick on"—*i. e.*, a plaster—would make the calling of a medical man impossible on this coast if seal and bear oil was not as acceptable to them as olive, if oakum and moss did not serve as well as padding for dressings, and if coniferous resins were not adhesive. Plain board beds seem to give rise to no bed-sores through their thick acclimatized skins.

An antipathy to anæsthetics would have rendered more than one operation impossible had it not been for their stoicism and inordinate pride in being the center of attraction, which, as a superior mental emotion, led one young woman to grin while I amputated her frost-bitten toe, just because the tent was filled with an admiring audience. It has always struck me that they would be good material for Christian science.

With dog stories and winter travels the coast just abounds, and many a night by a log fire I have listened to the most exciting yarns of old hunters. But here there is no room for these. Suffice it to say, I have tried most sports that young manhood in civilization affects, and I have yet to find a match for our winter traveling.

There are lots of poor, yes very poor, people in Labrador. I have seen nakedness and starvation every year that I have been here. That is why we are here, not merely because these are miserable people, but because those people we believe need not be miserable or starving or naked. It is true a man's work must in spite of him crystallize often enough into temporizing methods. It is the same in our professional and every other work at times.

But we believe in the country, and we believe in the people. The former can, we are convinced, evolve a worthy contribution to the human race—a people not enervated and enfeebled by the soft things of life or by artificial conditions. We hope to be factors in hastening the process.

It has been suggested to change the whole climate of Quebec by damming the Straits of Belle Isle and shouldering off the arctic current. Nothing is impossible. The north side of the Straits is an admirable spot at present for a penal settlement, and material is not lacking with which to fill up that shallow strip of water. A railway can be run with ease to the bottom of St. Lewis' Bay, and bring in its train increasing comforts and increasing facilities for living. But without these we have been privileged ahead to see the dawn of a better day, and we only stand grateful to Labrador for the opportunities it has afforded us.

NOTES ON THE DESERTS OF THE UNITED STATES AND MEXICO

Some desert plants have cisterns which they fill with water against the days of drought, just as the ant stores its cellar with grain and choice morsels in preparation for the days when it is imprisoned by the rain and snows of winter. Another species will spend many years to gather the force to send upward a single stalk of flowers and then immediately die as if contented, after years of labor, to perpetuate itself by this single blossoming. Other plants have developed hairy coverings and resinous coatings which protect them from the burning sun's rays and also prevent the evaporation of the water they have secreted. These and other wonderful characteristics of desert vegetation which have long excited the wonder and attention of botanists are now being systematically studied in the desert itself by the plant specialists of the Desert Laboratory, at Tucson, of the Department of Botanical Research of the Carnegie Institution of Washington. It is believed that these researches will result in much new information as to the origin and physiology of plants, and that they will also ultimately be of much practical assistance to the agricultural interests in sections where the rainfall is slight. The following article has been abstracted by the Editor from a recent publication by the Director of the Department of Botanical Research, Dr Daniel T. MacDougal, "Botanical Features of the North American Deserts." The illustrations are from this publication and are from photographs by Dr MacDougal.

TUCSON has a climate of a thoroughly desert character, and a flora, including mountains and plain, rich in species and genera. In addition to its situation in the heart of the desert of Arizona, it is centrally located, both as to position and transportation, with reference to the deserts of Texas, Chihuahua, New Mexico, California, and Sonora. The city has a population of nearly 22,000. It is situated on one transcontinental railway, and has good connections with others, as well as shorter lines to various regions of interest.

The business of the city and the conduct of its municipal affairs are largely in the hands of progressive Americans. The elevation of Tucson is 2,390 feet, while the highest of the mountains that surround the plain in which the city lies, the Santa Catalina Range, reaches about 7,000 feet higher. The University of Arizona, with its School of Mines, and the Arizona Agricultural Experiment Station are located at Tucson.

Not the least of the advantages of Tucson as a center for the activities of the laboratory is the broadminded comprehension of the importance of the purposes of the institution evinced by the citizens, accompanied by an earnest desire to coöperate in its establishment. This appreciation was expressed in the practical form of subsidies of land for the site of the building and to serve as a preserve for desert vegetation, the installation and construction of telephone, light, and power connections, and of a road to the site of the laboratory, about two miles from Tucson. The monetary value of these concessions is by no means small, and is much enhanced by the generous spirit in which they were tendered. This spirit of hearty coöperation has animated every organization in the city, and has enabled the laboratory to gain control of a domain of 860 acres, of the greatest usefulness for general experimental work.

IN THE "JOURNEY OF DEATH"

Extending northward for nearly 100 miles from El Paso is the noted Jornada del Muerto (Journey of Death), which has a width of 30 to 40 miles. It formed

COLUMN IN THE WHITE SANDS OF NEW MEXICO

The shade and mechanical action of the roots of the three-leaved sumac have prevented a section of a dune from being moved by action of the sun and wind, and it remains in columnar form (see page 693)

a portion of the route connecting the earliest settlements along the Rio Grande, and here the traveler was compelled to leave the stream far to the westward, in its deeply cut, inaccessible canyon, and toil for two or three days in the burning heat without water, except such as might be carried. It was for three centuries one of the most menacing and hazardous overland journeys to be encountered in the American Desert. Recent investigations, however, have shown that the region traversed is in reality a basin, and that water is to be found, as in many other deserts, within a reasonable distance of the surface.

Beyond lies an equally remarkable desert, the Otero basin, which is the bed of an ancient lake, and is noted for a great salt and soda flat, a salt lake, and, most striking of all, the "White Sands," an area of about 300 square miles covered with dunes of gypsum sand rising to a maximum height of 60 feet.

The surface of the dunes is sparkling white, due to the dry condition of the gypsum powder, but a few inches beneath it is of a yellowish or buff color and is distinctly moist and cool to the touch, even when the air is extremely hot. The smallest particles may be crumbled in the fingers, and as a consequence the dunes are solidly packed.

The most characteristic plant of the dunes is the three-leaf sumac (*Rhus trilobata*), which occurs in the form of single hemispherical bushes 4 to 8 feet high, the lower branches hugging the sand. The plant grows vigorously, the trunk at or beneath the surface often reaching a diameter of 3 inches. The binding and protecting effect of this bush is often shown in a striking manner when in the cutting down of an older dune by the wind a column of sand may be left protected above from the sun by the close covering of the branches and leaves, and the sand in the column itself bound together by the long penetrating roots. One of these columns was about 15 feet high from its base to the summit of the protecting bush and about 8 feet in diameter at the base (see page 692).

A curious fact brought out in the exposure of the underground trunks of this plant by the shifting of the dunes is the abundant exudation of a pale amber gum with the characteristic aroma of the crushed twigs. This, mixing with the sand, forms hard, honeycombed masses sometimes 3 inches in diameter.

A marked peculiarity of the White Sands is that a cottonwood is occasionally found in the lower dunes, reaching a foot in diameter, but seldom more than 15 feet in height; yet at the same time not a mesquite was seen. The mesquite is a tree requiring less moisture than the cottonwood. Apparently the presence of an excess of gypsum is prejudicial to the growth of the mesquite.

The bottoms among the dunes have a dense vegetation as compared with that of the dunes themselves. It is characterized especially by the presence of a grama grass (*Bouteloua*), forming almost a turf, and by frequent clumps of *Ephedra* of a grayish purple color at this season and with 3-scaled nodes. These bottoms usually show no sign of moisture, but in two places we found waterholes, the water so alkaline that the horses would not drink it at the end of their first day's drive.

The relation of *Yucca radiosa* to the sand dunes is unusually interesting. A group of four small yucca shoots standing about 3 feet high to the tip of the highest leaf was found upon the summit ridge of a 30-foot dune. We dug the trunk out to a depth of 14 feet. All four plants were from branches of the same trunk, the lowest branch arising about 16 feet from the base of the dune; the main trunk and the branches bore marks of rosettes of leaves at intervals all the way to the lowest point reached. The trunk sloped in the direction in which the dune was moving. The yucca originally grew on the plain, was engulfed by the sand, and gradually grew through each successive layer of sand that drifted over it until the summit of the dune was reached. In the vicinity, at the rear of the dune, were other long trunks partly denuded by the passing of the dune.

THE PLANT THAT OWNS A CISTERN

Probably the most extraordinary product of the Sonora Desert, west of Torres, Mexico, is the guarequi (*Ibervillea sonoræ*), a tendril-bearing plant whose inordinately thickened root and stem base lies gray and half exposed upon the ground beneath some trellising shrub (see page 696). These tuberous formations may be seen during the dry season lying about wholly unanchored, as the slender roots dry up with the close of the vegetative season, which lasts but a few weeks.

In February, 1902, some of these tubers were taken to the New York Botanical Garden, and a large specimen not treated in any way was placed in a museum case, where it has since remained. Annually, at a time fairly coincident with the natural vegetative season in its native habitat, the major vegetative points awaken and send up a few thin shoots which reach a length of about 2 feet only, since they do not obtain sunlight. After a period of a few weeks, they die down again and the material in them retreats to the tuber to await another season. Seven periods of activity have thus been displayed by this specimen with no apparent change in its structure or size. It does not seem unreasonable to suppose, therefore, that the guarequi is a storage structure of such great efficiency that water and other material sufficient to meet the needs of the plant for a quarter of a century are held in reserve in its reservoirs.

The guarequi is reputed locally to be very poisonous, but repeated tests by Dr William J. Gies and Miss Julia Emerson, with living material, hot and cold water extracts, and alcoholic extracts, fail to produce any results with the various animals used as test objects. It is quite possible, however, that the living vines or the fruits might yield substances upon which the prevailing opinion is based.

The morning-glory (*Ipomœa arborescens*) is here a tree 20 to 30 feet high, with smooth chalky gray trunk and branches. During February it is leafless throughout, while its large white flowers open one by one on the ends of the naked branches. From its white bark the tree is sometimes known as palo blanco, and from the gum or resin, which exudes from incisions made in it for the purpose and which is used as incense in religious ceremonies, it is called also palo santo.

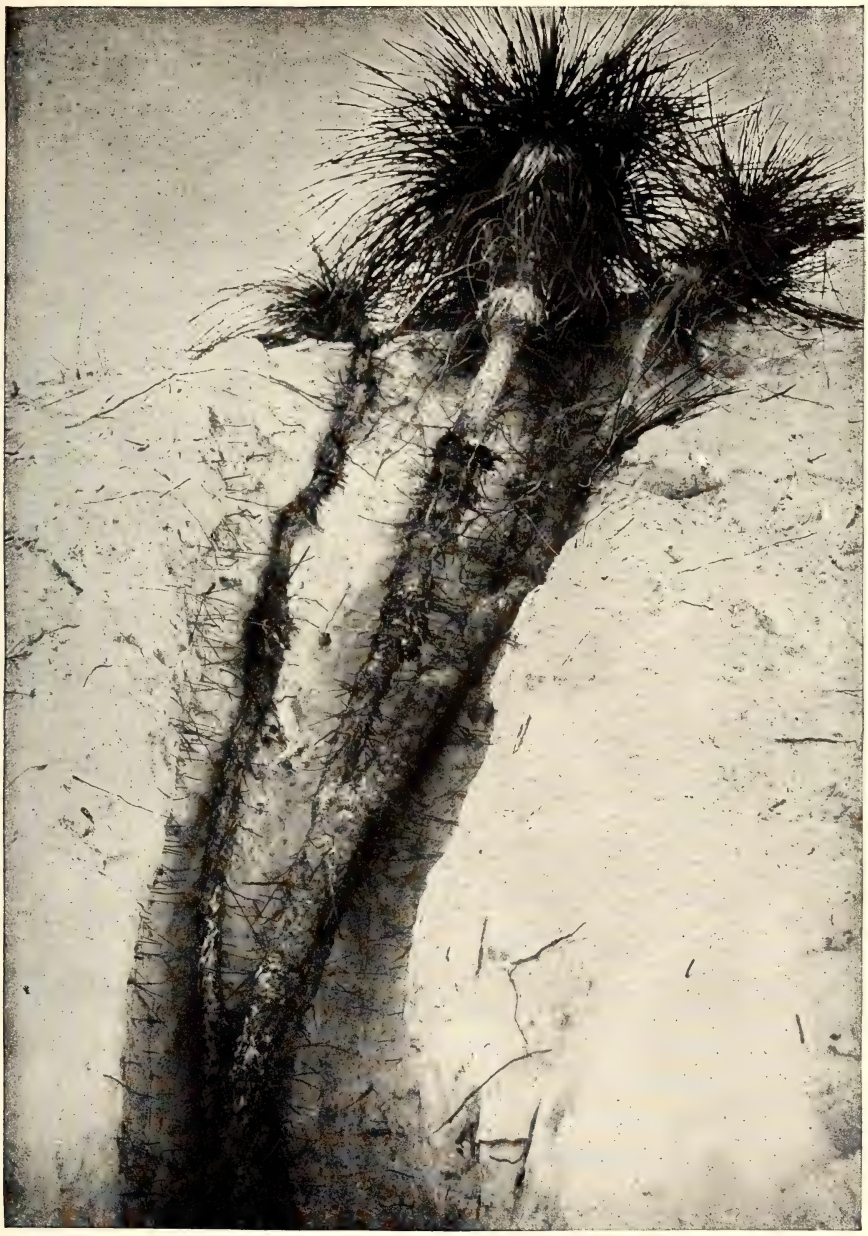
WONDERFUL CACTI THAT STORE HUNDREDS OF GALLONS OF WATER

One of the striking features of the Tehuacan Desert of southern Mexico is the extreme localization, or strictness of colonization, exhibited by many species which are found to cover an area of a few square yards, the face of a slope, the crest of a cliff, or the floor of a barranca, with no outliers and with the nearest colony perhaps many miles away.

The Cactaceæ are more abundant here than in any other part of the world yet visited, several of the species being massive forms, which constitute very prominent features of the landscape.

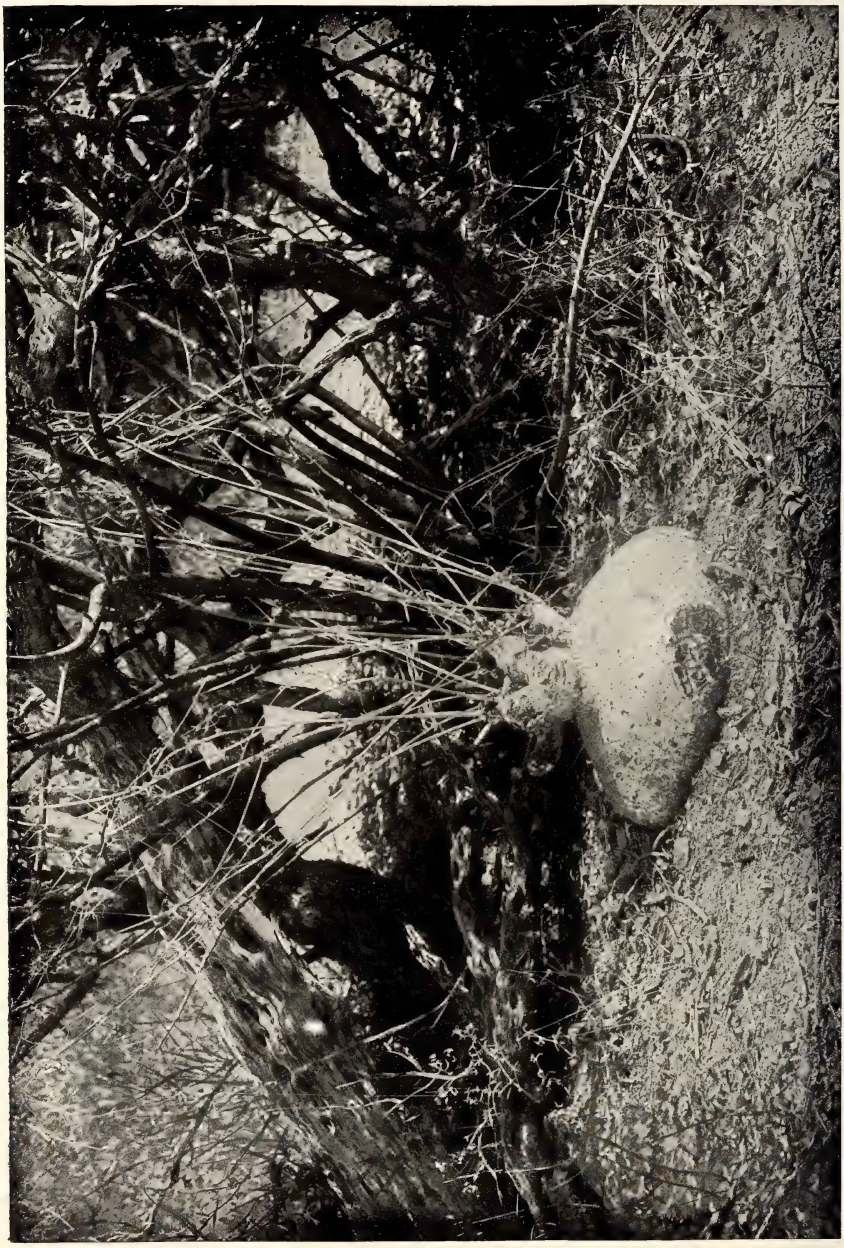
Cephalocereus macrocephalus (see page 698) is a tall species of the massiveness of the saguaro, and like it having a central shaft bearing numbers of branches which are more closely appressed. It was seen only along the cliff near the Rancho San Diego, along the eastern edge of the valley. *Pilocereus fulviceps* (see page 699), of more general distribution on slopes, has a series of branches, in many instances 40 or 50 in number, densely clustered and arising from a short trunk, which barely rises from the ground before it branches.

Echinocactus was represented by a half dozen species, of which one, *E. grande* (see page 701), is undoubtedly the most massive of all the genus, being as much as 8 or 9 feet in height and 30, or even 36, inches in thickness, which, with the many convolutions of its surface, makes it a very grotesque feature of the scenery. The young of this species are characterized by very striking cross-stripes which disappear with age. Upon testing the pith to compare the watery content with the northern species, it was found that so much calcium had been taken up and stored in the form of calcium oxalate or



Yucca radiosa

Which has elongated its stem sufficiently to keep its crown above a moving gypsum dune 30 feet high, the crest of which has passed it a few feet. The excavation has laid bare a trunk twice the ordinary length. White Sands of New Mexico (see page 693).



A REMARKABLE VINE, THE GUAREQUI (*Ibervillea sonoræ*), WHOSE LARGE EXPANDED STEM-BASE SERVES AS A STORAGE ORGAN (SEE PAGE 694)

carbonate that the tissue was unpleasantly gritty when chewed, and that its crispness made it difficult to express the juice.

E. flavescens (see page 700) forms small heads in clusters, while in *E. robusta* colonies 10 or 15 feet across, making mounds 2 or 3 feet high, include hundreds of heads.

No systematic account of any desert is to be found in which the storage function appears so highly developed and by so many species. Of course, all of the cacti exhibit this feature in a very marked degree, and a single plant of *Pilocereus fulviceps* may retain several hundred gallons of water. The large stems of *Yucca,* which is a prominent member of the flora of the slopes, function to this purpose to some extent, while the fleshy leaves of *Agave marmorata* and other species, and of *Hectia,* are essentially storage organs for reserve food and surplus water. Here is also a *Euphorbia* and a *Pedilanthus,* with thick upright cylindrical stems, in which the storage function is made more effective by the possession of a thick milky juice.

The tree morning-glory (*Ipomœa*) has a soft, thick trunk, into which a knife may be easily thrust to the hilt, the tissues being highly charged with water and containing some reserve food material.

Perhaps of all of the plants which show this capacity, however, *Beaucarnea œdipus* is the most remarkable. This relative of the *Yucca,* like all plants of this group with narrow leaves, is known as "sotol," and has the bases of the trunks swollen in adult specimens to a diameter of 7 or 8 feet, the topmost branch not reaching a height of more than 25. This trunk has a truncate base resting almost upon the top of the ground, to which it is attached by a few slender roots. After death, the loss of water reduces the weight of the storage organ so much that a large plant may be easily toppled over as it stands.

IN THE DESERT NEAR MITLA, MEXICO

As one proceeds to the ancient ruins of Mitla, 36 miles to the southeastward of Oaxaca, the aridity increases until in the vicinity of the hacienda of that name extreme desert conditions are found. The ancient structures here are indicative of a type of civilization characteristic of the desert, in which coöperation or communism was carried to as great lengths as it must have been in the pueblos of the northern deserts in America.

A short distance to the eastward from Oaxaca lies the village of El Tule, in which grow a large number of cypress trees (*Taxodium mucronatum*), one of which stands in the churchyard, and by the claims of local patriotism is the greatest in the world, while for a long time it has been cited as the oldest living. Both of these claims are incapable of actual proof, although the tree has much to justify an interest in it. Six feet from the ground it measures 154 feet in circumference, but it may be really two or three individuals fused together, as it divides into that many main branches within 50 feet. This tree has been an object of observation for more than two centuries, and on one side is a tablet, partly covered by the growth of the outer layers of the trunk, signed by the great naturalist, Baron von Humboldt, and probably placed there by his direction a century ago.

From El Tule to Mitla the way passes between fields illustrating methods of agriculture in an arid tropical climate. Not the least interesting of these features are the crops of maize of species either primitive or directly derived from one of the elementary species of *Zea.* The highway, especially where it passes through small villages or near a hacienda, is marked off from the fields and compounds by barriers of cacti grown in dense rows. Two or three species of *Cereus* and several prickly-pears are used for this purpose and also yield a valuable crop of fruit for the owners.

At Mitla the opportunity was offered for seeing the manufacture of mescal from *Agave.* Plants of several species and horticultural varieties of *Agave,* as well as of *Yucca* and *Dasylirion,* are uprooted at a time when the plant is about

A TREE-CACTUS NEAR TEHUACAN (*Cephalocereus macrocephalus*)

An epiphyte, a bromeliad, is seen attached to the branches

A MASSIVE TREE-CACTUS NEAR TEHUACAN, MEXICO (*Pilocereus fulviceps*)
Several hundred gallons of water are stored in its fiber (see page 697)

Echinocactus flavescens: TEHUACAN, MEXICO

Another kind of desert cactus which also stores many gallons of water for the long dry months

Echinocactus grande: TEHUACAN

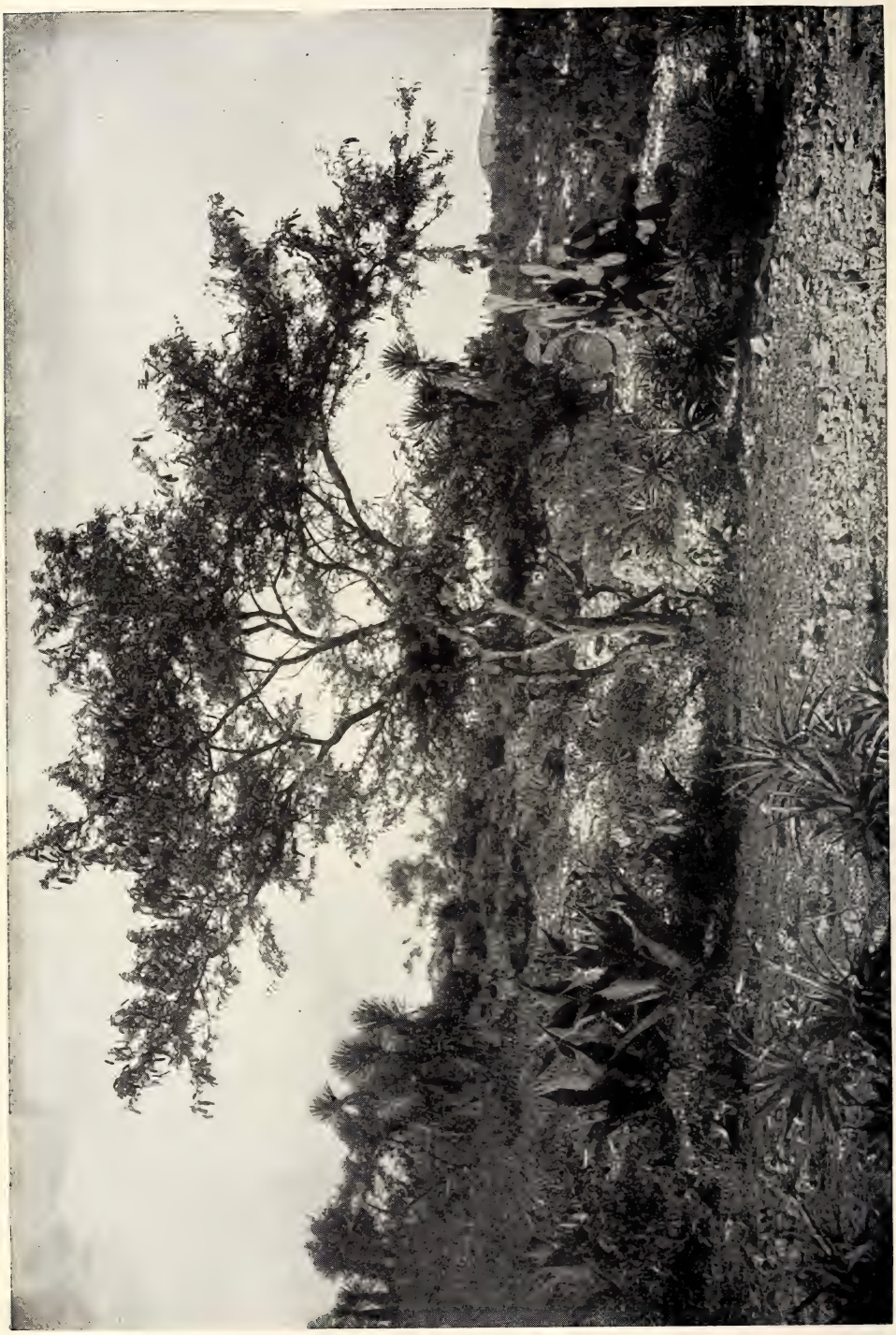
A plant of great age and maximum size (see page 694)

to send up its long inflorescence axis and is loaded with sugary substances. The leaves and roots are trimmed away, leaving a huge core in the case of the large agaves. A large pit is heated by means of a hardwood fire built in it, and after being cleansed of ashes and the remains of the fire the cores are piled in the cavity and covered, and allowed to bake slowly for two or three days.

Next the pit is uncovered and the cores removed to a large vat made by sewing the edges of three or four cowskins together and suspending them from a framework of rough branches. Fermentation is allowed to act upon the sugary material for a week or ten days, and then the unpleasantly smelling liquid is dipped out and put in the kettle of a rude still, the cap of which is connected with pipes cooled with water run in wooden conduits from a stream near by. The resulting liquor contains a mixture of several alcohols and is exceedingly fiery, being a true whisky of a desert people.

TWO POPULAR THEORIES WHICH ARE ENTIRELY WRONG

The Colorado River cuts directly into the gravelly plain or mesa of the Sonoran Desert at four points on the eastern margin of its delta. At these places may be found within a compass of 100 feet the most vivid contrasts of rank swamp vegetation and water-loving plants having broad leaves and delicate tissues with the toughened, spinose, and hairy xerophytic forms of the desert. The presence of the moist area of the delta has but little effect upon the climate of contiguous arid regions, although a popular supposition to the contrary promises to be immortal. The relative humidity here is often as low as 17 per cent within 50 feet of the margin of the water.



GROUP OF DESERT VEGETATION ON LIMESTONE SLOPES NEAR EL RIEGO, TEHUACAN
Hectia, Agave, Yucca, Euphorbia, Opuntia, and a leguminous tree are to be seen

The armature of desert plants is often thoughtlessly cited as an adaptation by which these forms protect themselves against the ravages of animals. The presence of spines undoubtedly operates to prevent a plant from being eaten by animals, but the action of the animals has in no wise induced their formation by the plant. As a matter of fact, the fatality among desert plants by injury from animals is greatest in the seedling stage. For every prickly-pear that survives, tens of thousands of seedlings are eaten by rodents, and these seedlings are as unarmed as those of any other type.

CHANGE OF CLIMATE

A change of the climatic conditions throughout the Southwest, and especially in the semi-desert region of Arizona and New Mexico, is marked everywhere by the evidence of a much heavier rainfall than we now have. River valleys in many cases show only dry gravelly or sandy beds which evidently were formerly occupied by continuous streams. The floods that once carved their way across the slopes or over the plains are no longer seen, at least not in the same volume as in former time. Even existing streams do not reach in times of great flood their former volume and carrying capacity. All tell of diminished volume, whether in the desert regions or in the regions of abundant plant-growth.

We may believe that the cause is extraterrestrial and cosmic, and a part of the great era of climatic changes giving to the earth the glacial era, and its gradual decay. We may believe that the era of greatest precipitation in the Southwest and elsewhere was coincident with the widest extension of the glaciers and that while the higher mountains were being loaded with snow, the lower slopes were deluged with rain or watered freely by the melting snows and enjoyed a verdure no longer possible.

EXTINCTION OF THE GREAT MAMMALS

The fact of the existence and wide geographical range in Arizona of the great mammals, the mammoth and the mastodon, shows a very different condition of vegetation up to comparatively recent geologic time. The extinction of these giant herbivores may be best explained upon the theory of the desiccation of the region rather than by a change of temperature or increasing cold, as apparently was the case in Siberia, and may have been in the glaciated regions of California. A great change in the rainfall and the drying up of the slopes and mesas of Arizona must of necessity have caused a great change in the growth of plants, involving their destruction over great areas. It would appear that the extinction of the giant mammals and the disappearance of suitable vegetation for their sustenance proceeded together, and were due to increasing heat and dryness rather than to increasing cold.

We have ample evidence that in the Cretaceous era conditions in Arizona were favorable to forest growth and luxuriant vegetation. The coal-beds of Deer Creek near Saddle Mountain in Pinal County, described by Emerson, reveal such conditions.

Quantities of silicified tree trunks in the vicinity of Yuma and the prostrate forms of giant trees turned to stone in the Petrified Forest Park bear eloquent testimony to such forest growths and to destructive climatic changes in Tertiary time.

More recent evidence is found in springs surrounded by relics of vegetation, such, for example, as Andrade's Spring east of Tucson and on the right bank of Davidson's Canyon, where there is a thick accumulation of sphagnum with stumps of trees and, at the bottom, teeth of the mastodon.

The former existence in Arizona of a species of *Bos* of unusual size is shown by the discovery of enormous horn-cores in the gravels of the secondary or derivative slopes of the Santa Ritas at Greaterville.

THE CACTUS FLOWERS AND PRICKLY PEARS

The greatest activity among the cacti is displayed by the cereuses and opun-

tias. The earliest of these in the vicinity of Tucson is generally *Echinocereus fendleri,* in which a few brilliant crimson flowers are displayed from the clumps of short, thickened, cylindrical stems late in March, and continue for a month, to be accompanied and followed by equally noticeable bloom of two or three other small species (see pictures, pages 705, 710, 711).

Chief of the group, however, is the great saguaro, the flower-buds of which develop as dense clusters on the portions of the apices of the stems most exposed to the sun, and have been seen to open on March 25. The whitish flowers each remain open but a short time, and apparently are pollinated by insects. A succession of them ensues, and although practically finished during May or June, yet belated buds open at various times, one having been seen as late as the middle of November. The seedy fruits mature in great quantity in midsummer, and are much prized by the Papagoes, who make much use of them in various ways.

The prickly pears, or opuntias, with flat stems, begin to make some growth of new joints and to push out flower-buds in March, and late in that month or early in April bloom in great profusion, the fruits maturing early and dropping to the ground. Fifteen or twenty species are native to the Tucson region, but the greatest confusion prevails as to their identity. Of the various desert plants, this group has been the subject of the most inquiry as to its possible economic utilization.

After a consideration of the various practical questions connected with open cattle ranges, it has been found that the best use of them for forage is made by growing or allowing to grow spinose species, from which the spines are burned when they are to be consumed by animals. This is now done with the plants growing in various places. Unarmed forms are subject to the attacks of so many animals that it is practically impossible to secure a crop without protecting fences. A few species are known in which the spines are very sparse. One of these, *Opuntia lævis,* occurs in the canyons of the Santa Catalina Mountains, but chiefly on rocks or in places inaccessible to grazing animals.

THE SEEDS OF THE DESERT PLANTS ARE AS EXTRAORDINARY AS THEIR STORAGE ABILITY

Several species of birds make their nests in the branches of the cylindrical opuntias, where they are secure from hawks and marauding animals, and *many rodents of the desert drag the detached joints about their burrows, making an effectual barricade against the coyote and fox.*

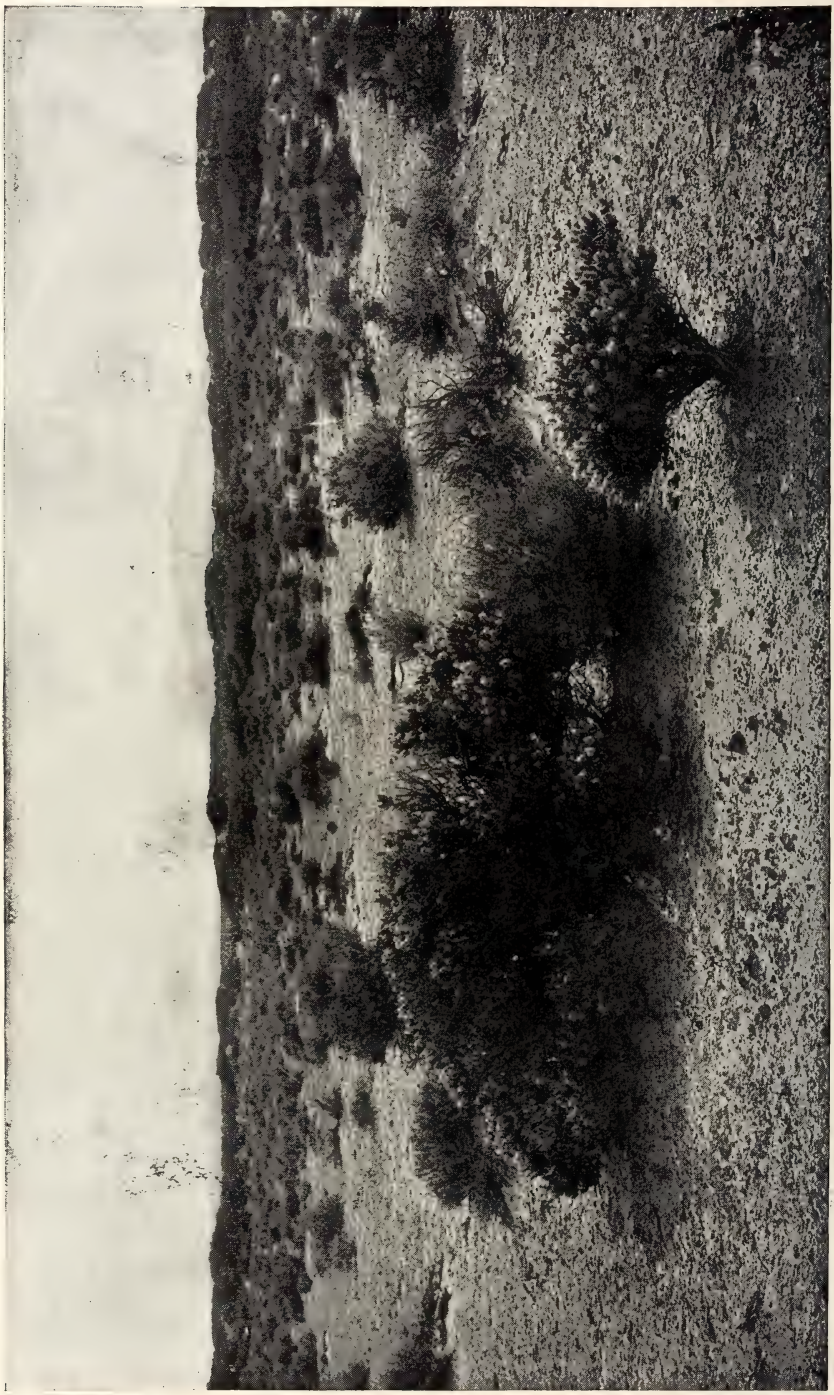
The agaves form their great rosettes of thickened leaves on the slopes running up from the greater mesas, and after a period of development, which varies from a few to many years, a central flower-stalk is sent up in the foresummer with extraordinary rapidity, growing in length as much as a foot a day and quickly forming flowers and seeds. This effort exhausts the resources and terminates the life of the individual, and the entire cycle of these "century-plants" is directed to this one effort of arriving at mature size, with an accumulated food supply that will enable them to perfect a crop of fruits and seeds.

This habit makes the agaves an important source of food for the southwestern Indians, who take the rosettes when nearly mature, and, after cutting away the tips of the leaves, bake the central stem and attached leaf-bases for the sugary substances to be obtained, making what is known as mescal. The mescal-pits, used a decade ago, are numerous in the foothills of the mountains in this region, and even yet one may occasionally surprise an Indian feasting upon this prized delicacy (see page 712).

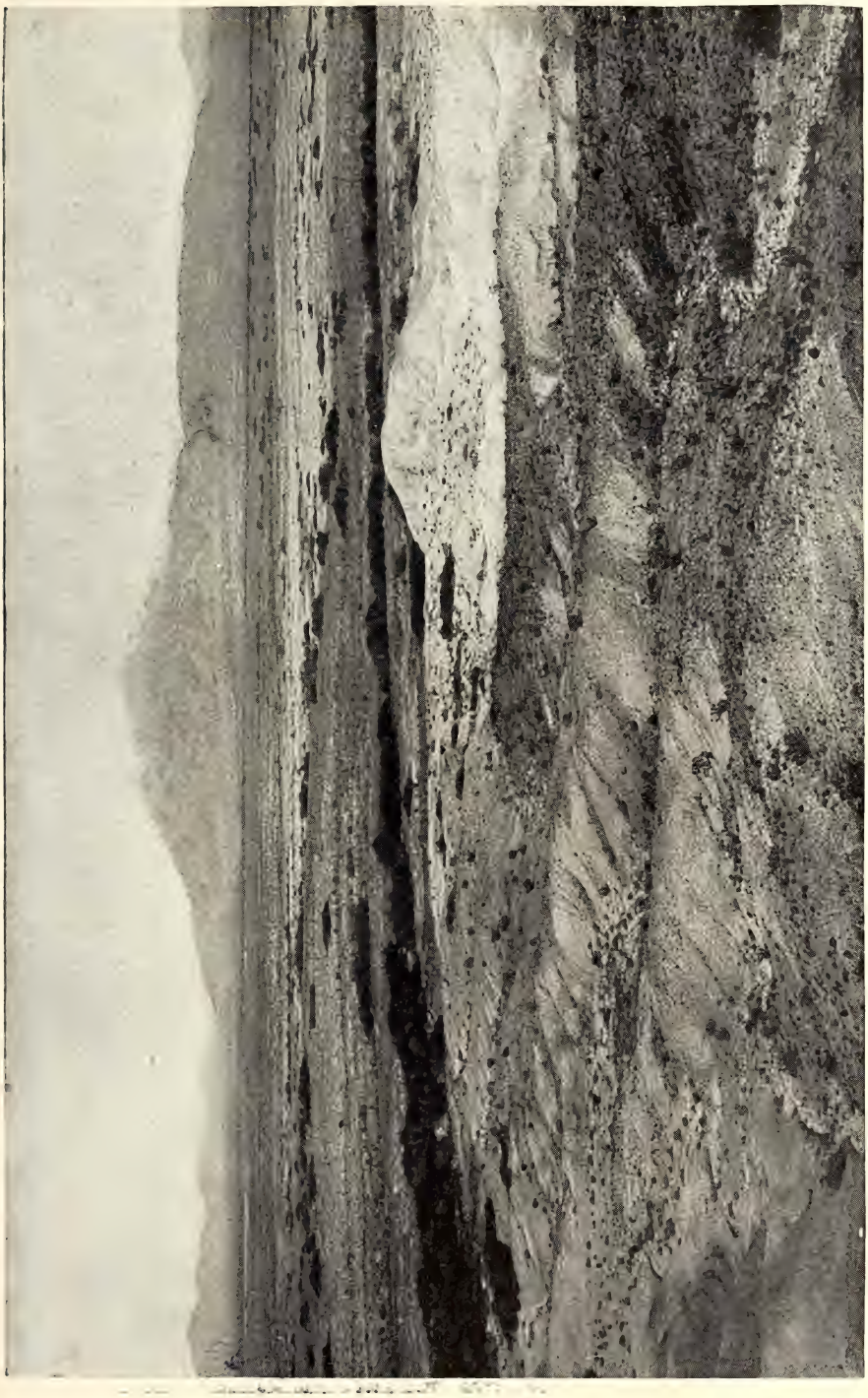
The seeds of the saguaro, which are produced in enormous quantities, are devoured by the birds before being freed from the fruits, but of the great number that reach the ground and germinate, not one in a million survives and makes the curious globular plantlet a few

THE MOST MASSIVE OF ALL CACTI, *Cereus weberi:* TOMELLIN, MEXICO

The human figures, which may be indistinctly seen at the foot of the tree, give an idea of the great size of this cactus. The numerous thick branches all arise from a central stem within a few feet of the ground.



CLUMPS OF DESERT VEGETATION NEAR LAS VEGAS, NEVADA: *Petalomyx nitidens* IN FOREGROUND



THE DESERT PLAIN OF LAS VEGAS, NEVADA, SHOWING EXPANSES OF LOOSE ALKALINE SOIL

OASIS OF PALMS (*Nerwashingtonia filifera*) IN THE MOUTH OF A CANYON NEAR INDIO, COLORADO DESERT

inches in height, eventually destined to become a giant cactus. The seedlings of all the cacti form a favorite food of a large number of small animals, being juicy reservoirs of water, and containing enough other material to lead to their destruction before sufficient armament has been formed for their protection.

The seeds of the winter annuals of the Desert of Tucson show amazing endurance. Seeds are ripened and thrown on the ground in March and April. The surface layers of the soil reach a temperature of over 100° F. during the summer months. The summer rains come and soak both the soil and seeds, but still no activity is shown, and the experimentalist who attempts to use these plants during the summer will find that he might as well have sown so many pebbles in his pans.

PORTIONS OF THE DESERT HAVE BECOME HABITABLE

Formerly the desert was held to be an uninhabitable place, but by the aid of the devices of modern civilization the requirements of life, comfort, and luxury may be transported to the most remote deserts, and large populations may carry on pursuits, such as mining, unconnected with the climate, regardless of aridity. One of the most important developments of modern agriculture is that of dry farming, in which forms of economic plants are sought which will produce crops under arid conditions, and constant and assiduous attention is being given to the development of cultural methods which will facilitate the growth of plants in deserts and conserve the soil moisture by checking evaporation. These and other individual adaptations of the human animal are of extreme interest, particularly when considered by the archeologist engaged in the study of the ancient civilization of desert peoples.*

One of the most difficult problems to solve is that of transportation in the desert, and there are extensive areas in American deserts that have not yet been systematically explored by reason of this condition.

The camel is perhaps the most extensively used of any means of transportation, and as such he has played an important part in the history of the human race in the arid regions of Asia and Africa. This animal has also come to be of great usefulness in Australia, where it was introduced in 1846, and a later importation of these animals, brought in 1860, accompanied the Burke and Wills Expedition across the continent.

In this same period efforts were made to make use of the camel in American deserts, and although the conditions were undoubtedly and still seem quite as favorable, the movement was a failure by reason of prejudice and of the organization of transport of burros, horses, and mules, already in a high state of specialization in this region. The extension of railways to tap mining regions and the usefulness of the modern motor car, as proved in the deserts of Nevada, now make any further consideration of the camel unnecessary along main lines of travel, while the solitary traveler or the small party following personal routes have available animals and supplies, so that the most economical outfit is that of horses, mules, and burros. A camel is reputed to be able to carry a load of 600 pounds with ease, but the same amount might be taken by three or four burros at a cost of original investment and maintenance only a fraction of that of the camel-train.

It is to be said, however, that a small efficient camel-train would make possible the scientific exploration of the deserts of western Sonora and of the region traversed by the Camino del Diablo with some certainty of success.

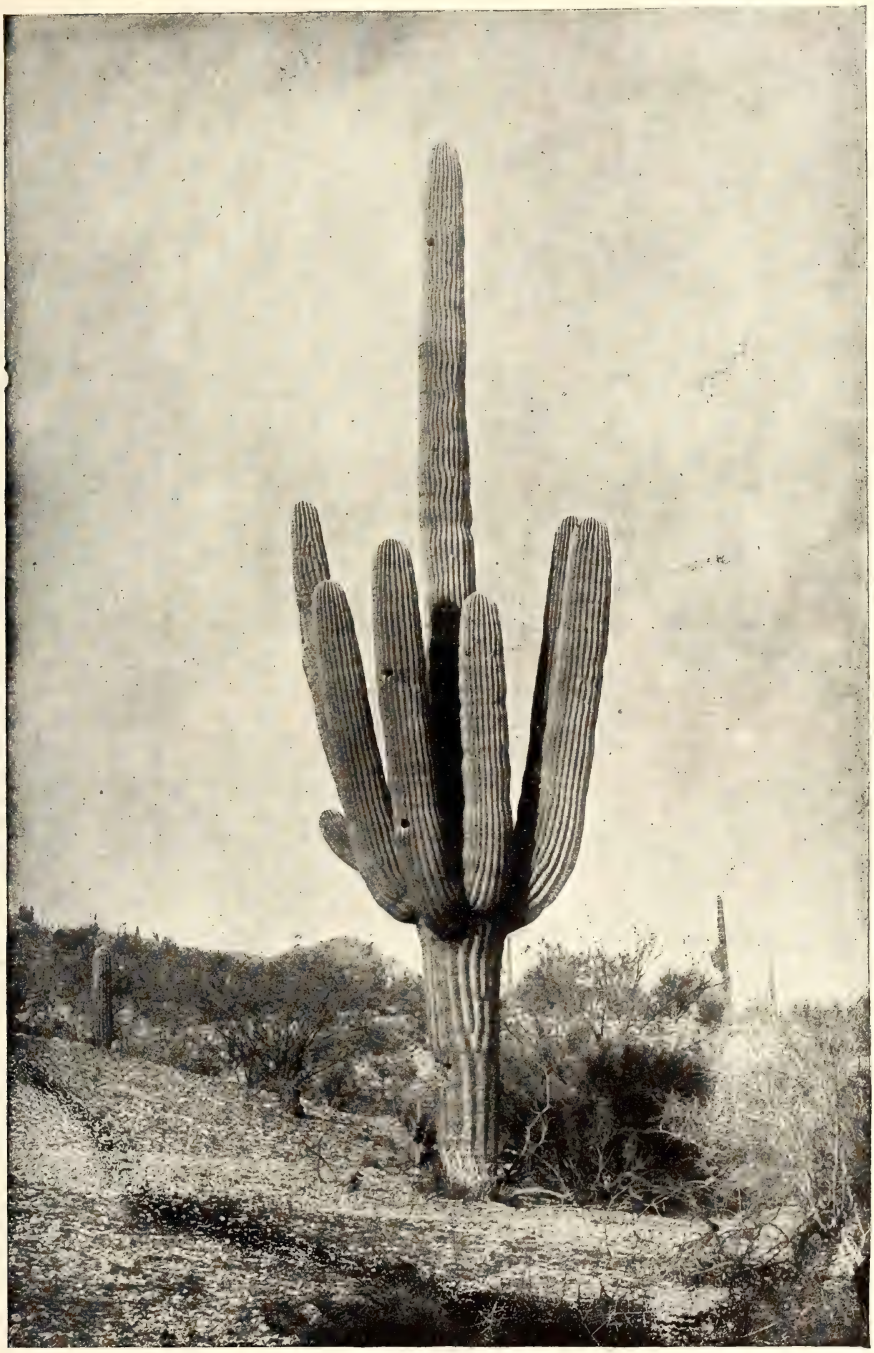
HOW LONG CAN MAN LIVE WITHOUT WATER?

A comprehension of the part that water plays in existence and travel in the desert is to be gained only by experience.

*C. S. Scofield: Dry Farming in the Great Basin. Bulletin No. 103, Bureau of Plant Industry, U. S. Department of Agriculture, Washington, 1907.

TWO CLOSELY RELATED PRICKLY PEARS GROWING WITH BRANCHES IN CONTACT, *Opuntia fulgida* (CHOLLA) AND *O. mamillata*

Both bear numerous maturing fruits: Tucson (see page 704)



SAGUARO, OR GIANT CACTUS (*Cereus giganteus*), NEAR MOUTH OF SALINA CANYON, SANTA CATALINA MOUNTAINS

The openings in the trunk and branches lead to large sac-shaped cavities, originally excavated by woodpeckers for nests, and afterward occupied by several other species, as well as colonies of honey-bees. This specimen is about 40 feet in height (see page 714).

PAPAGO INDIAN DRINKING FROM A CACTUS (*Echinocactus emoryi*) WEST OF TORRES, MEXICO

CRUSHING THE PULP OF A DECAPITATED BISNAGA (*Echinocactus*) TO OBTAIN A DRINK IN CENTRAL ARIZONA

*Some of the native animals, such as mice and other small rodents, have been known to live on hard seeds without green food for periods of several months, or even as long as two or three years, and nothing in their behavior indicated that they ever took liquid in any form.**

Deer and peccary are abundant in deserts in Sonora in which the only available supply of open water is to be found in the cacti. The endurance of the camel is well known, and some of the best authenticated evidence upon the matter comes from Australia. The camels of the Tietkins party in 1891 and 1892 made a march of 537 miles in 34 days without a drink. These animals take water every day when a supply is available, but it is their capacity for accommodation that has made them such a potent factor in transportation in the deserts of Asia, Africa, and Australia. Other animals, including the common domestic sheep, are also capable of making such changes in their habits that they may go for weeks without a drink.

Man and his most constant companion on the desert in America, the horse, are comparatively poorly equipped against the rigors of the desert. A horseman may go from the morning of one day until some hour of the next in midsummer and neither he nor his horse will incur serious danger; experiences of this kind are numerous. If the traveler is afoot, abstinence from water from sunrise to sunset is a serious inconvenience to him, and if he continues his journey, the following morning his sufferings may so disturb his mental balance that he may be unable to follow a trail, and by the evening of that day, if he has not come to something drinkable, he may not recognize the friendly stream in his way. Instances are not unknown in which sufferers from thirst have forded streams waist deep to wander out on the dry plain to a grisly death.

Some estimate may be made of the actual amount necessary from the fact that a worker at the Desert Laboratory during the course of an ordinary day in May, at Tucson, consumed 16 pints of water. A horse would have used 15 or 20 gallons in the same time. A walk of 3 or 4 miles was taken, but no special muscular effort beyond this was involved. A march across the desert in midsummer would increase this quantity by half. Under such circumstances, a canteen of less capacity than a gallon is a toy, and one of real usefulness should contain at least twice that amount.

The most notable example of endurance of thirst is that of a Mexican prospector hunting for a "lost mine" near the old Camino del Diablo, or trail from Sonora to Yuma, who made camp safely after being out for eight days with a supply sufficient for one. This experience is not likely to be duplicated soon, although it is reported that Indians often go as long as four days without water.*

The experience of the field expeditions from the Desert Laboratory demonstrates that saline or alkaline waters which contain as much as one-fourth of 1 per cent of salts may be used for periods of many days without serious discomfort, but if the proportion be increased to one-third of 1 per cent only hardened travelers may use it, while water which contains as much as one-half of 1 per cent is inimical to health and comfort, although it might suffice for a few hours or save the life of a person who had been wholly without water.

All devices for allaying the discomfort arising from the dryness of the mucous membrane, such as carrying bullets or pebbles in the mouth, chewing grass or a piece of rubber, are wholly futile in meeting the serious thirst problem. The relative humidity often falls to 5 per cent in the Southwestern deserts, and in a temperature of over 100° the evaporation from a vessel of water standing in the open may be as much as an inch a day. The amount thrown off by the skin is correspondingly great, and if the loss is

*F. V. Coville: Desert Plants as a Source of Drinking Water. Smithsonian Reports for 1903, pp. 499-505.

*W J McGee: Desert Thirst as a Disease. Interstate Medical Journal, vol. 13, No. 3, 1906.

not made good, thirst ensues, and ten hours' lack of water may thicken the tongue so that speech is impossible.

THE BARREL CACTUS

The Indian and the desert traveler often seek relief in the juices of plants when water fails. The fruits of some of the prickly-pears are slightly juicy, the stems of the same plant or the great trunks of the saguaro contain much sap, but for the most part it is bitter, and while it would save life, in extremity, yet it is very unpleasant to use.

The barrel cactus, or bisnaga (*Echinocactus*), however, contains within its great spiny cylinders a fair substitute for good water. To get at this easily one must be armed with a stout knife or an ax with which to decapitate the plant, which is done by cutting away a section from the top. Lacking a suitable tool, the thirsty traveler may burn the spines from the outside of the bisnaga by applying a lighted match, and then crush the top with a heavy stone. This or other means is taken to remove a section 6 to 8 inches in thickness. Next a green stake is obtained from some shrub or tree that is free from bitter substances, and with this or with the ax the white tissue of the interior is pounded to a pulp and a cavity that would hold two gallons is formed. Squeezing the pulp between the hands into this cavity will give from 3 to 6 pints of a drinkable liquid that is far from unpleasant and is generally a few degrees cooler than the air.

Scouting Indians have long used the bisnaga, and a drink may be obtained in this manner by a skilled operator in 5 to 10 minutes. Some travelers are inclined to look with much disfavor on the liquid so obtained, but it has been used without discomfort by members of expeditions from the Desert Laboratory. That it is often preferred by Indians to fair water is evinced by the fact that the Whipple Expedition found the Mohaves near the mouth of the Bill Williams River, in 1853, cooking ducks and other birds in the juice of these plants by means of heated stones dropped into the cavity containing the pulp.

The sap of the saguaro (*Cereus giganteus*) and of other cacti contains bitter substances that make it impossible to be used to allay thirst by man, although it may be given to burros. A supply is usually obtained by felling the heavy trunk and elevating the ends a few inches above the ground, while the middle is allowed to sag lower over a bucket or vessel that has been suitably placed in a hole in the ground below. A cut is made above the bucket to allow the liquid to escape, while the process is hastened somewhat by building a fire under the ends.

The experiences of the expeditions from the Desert Laboratory made it evident that a still or condenser, by which even a small quantity of drinkable water could be obtained from the abundant sap of these plants or from alkaline waters, would greatly facilitate field-work. After some experiment, one was designed by Mr Godfrey Sykes, in which the cactus pulp or liquid to be distilled is placed in a boiler of pressed steel. This apparatus is now used by the laboratory parties while at work in the deserts. It has a capacity of several gallons per day, which enables a party to make an extended stay at a locality where the untreated water is undrinkable.

CAMP FIRES ON DESERT AND LAVA*

THE expedition described in this most valuable book was an exploration of a genuine terra incognita, for while it is true that the Pinacate region, lying in the northwestern corner of Mexico, or, broadly speaking, in the Sonoran Desert between Tucson, Arizona, and the Gulf of California, was known to a few Papago Indians and several Mexicans, it was totally unknown to the outside world. There was no information whatever about this region, and on all available maps the space around the Pinacate dot was an absolute blank.

Naturally, the animal and plant life of the Pinacate region was as much unknown as its geography; hence the value of the results obtained to the botanist, zoölogist, sportsman, and geographer.

Mr Hornaday tells in a graphic way of the wonders of the desert region, of extinct volcanoes, the marvelous desert botanical gardens, and of hunting mountain sheep in the lava, together with chapters of absorbing interest on the legend and history of that country, the book being splendidly illustrated with photographs of the expedition.

Describing the desert vegetation, the author says: The White Brittle-bush, as seen standing alone on bare black lava, is truly a thing of beauty. It is hemispherical, symmetrical, immaculate, and clean as a new shirt. It is a big white bouquet. Its leaves are all on the outside, and although its branches are large and stocky—for the storage of water they are so brittle that you can grasp a great handful of the outer stems and, with one movement, snap off every one of them as if they were so many pipe-stems of clay. The leaves are very large—for a desert plant—the blade being shaped like a broad arrow-head, one and one-half inches long by one and one-quarter wide. The flower is a little yellow composite, like a tiny yellow daisy, thrust far up on the tip of a frail and friable little flower-stalk six inches

* "Camp Fires on Desert and Lava." By Wm. T. Hornaday, Sc. D., pp. 366, 50 illustrations, 8 in colors. Charles Scribner Sons: New York. $3.30 postpaid.

THE WHITE BRITTLE-BUSH

Photo from D. T. MacDougal

DETAILS OF TYPICAL DESERT VEGETATION ON HILLTOP AT SANTO DOMINGO

Pack-Rats' nest; a new species of cactus—*Opuntia kunzei*; creosote bushes; skeleton of a dead tree, *choya*, in left middle distance; two white cottonwoods in distance, near river; and in upper right corner an *Opuntia versicolor*

VIEW OF PINACATE ACROSS THE LAVA FIELD, FROM THE TULE TANK

higher than the periphery of the foliage. We found few of them in flower, but enough for our inquisitive purpose. To the taste, the foliage is strongly aromatic, pungent, and bitter, and recalls the foliage of the common sage-brush (Artemisia). Apparently no animal eats the stems or foliage of the White Brittle-bush, and we are very glad of it, for it is truly a soft and pleasing thing to contemplate on the scowling lava-fields. The mountain sheep doubtless shared our views, since nearly every one killed was found to have browsed amply on the slender, delicate dead flower-stalks of the last season that still adhered to the stems and projected above the grayish-green mass. This bush is said to be widespread in the southwestern desert, but I did not notice it anywhere outside the Pinacate-Sonoyta region, which may have been my fault.

Naturally, in such a wild and weird spot as the Pinacate region, every plant, tree, and living creature is of interest—rendered so by the grim surroundings and the intensity of the struggle to survive. It is fair to assume that the plant life we saw at the Papago Tanks represents only the bolder and hardiest species of the southwestern desert region, because were they otherwise they assuredly would not be there.

BOOK REVIEWS

Physical and Commercial Geography. By H. E. Gregory, A. G. Keller, and A. L. Bishop. Pp. 8 and 469, 9 x 6. Boston: Ginn & Co. 1910.

Most commercial geographies contain more or less physical geography, since without a knowledge of the physical environment no adequate study of the economic condition of a country can be made. But this is, we believe, the first commercial geography which has included the word "physical" in its title. The book is in three parts, the different parts having been prepared by the authors severally. They are as follows:

(1) A description of the natural environment, physical geography, to which is devoted 123 pages; (2) the relations of man to this environment, to which is given an equal amount; (3) the products, industries, and commerce of the United States and the British and the German Empires absorb the remainder of the book.

This book more nearly meets the need for a text-book on its subject than any of its predecessors. Most of the works on commercial geography are, because of their fullness of detail, rather books of reference than text-books. This one treats few commodities, but representative ones, and few countries, but those the leading commercial countries. Special importance is given to the relations of man to his environment, the climate, fauna, flora, topography, water, etc., and his adaptability to changes in it. Means and routes of transportation and their development are discussed, and the increase of trade with increasing civilization. The book is illustrated with twenty-nine maps and diagrams. H. G.

Beyond the Mexican Sierras. By Dillon Wallace. Pp. 35 and 301, 5½ x 8. Chicago: A. C. McClurg & Co. 1910. Price, $2.00.

This is a narrative of journeyings in a little-known land, southwestern Mexico. The story is graphic and full of interest. The illustrations are abundant and excellent. Here is a region comprising many thousands of square miles very sparsely populated with Indians and full of big game; a region of the greatest agricultural and mining possibilities, lying undeveloped at our own doors. H. G.

The Indian and His Problem. By Francis E. Leupp. Pp. 14 and 369, 5½ x 8. New York: Charles Scribner's Sons. 1910.

The best book on the Indian that was ever printed. Mr. Leupp writes with fullness of knowledge of the characters of the Indians, of their history, and of the conditions which surround them. He thoroughly believes in the policy now in execution of making citizens of the Indians as rapidly as possible, consistent with their well-being. It is much to be regretted that Mr. Leupp could not have remained at the head of the Indian Office until this and other reforms with which he was identified could have been completed. H. G.

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THE NATIONAL GEOGRAPHIC MAGAZINE

NOTES ON THE ONLY AMERICAN COLONY IN THE WORLD

BY EDGAR ALLEN FORBES

With Photographs by the Author

"LIBERIA is an American colony." This brief sentence is not as commonplace as it looks. An American colony? Of course. Was it not founded by the American Colonization Society, in conjunction with the United States Government, on land "acquired by purchase from the lords of the soil"? Nobody else participated in its founding; even the West Indian settlers came at a later period.

As a republic it has a declaration of independence, a constitution, and a flag, all modeled closely after our own, and its people have never claimed kinship with any other hemisphere but ours. As a matter of fact, Liberia is the only place in the world where the American people have established a colony made up mainly of Americans. And yet, up to the time of Secretary Root, the most that an American Secretary of State would admit was this: "*To the United States it is an object of peculiar interest.*"

Liberia is unique in another respect: it is the only part of the black man's continent that is now governed by the black man himself. All Africa is European except Abyssinia, Tripoli, Morocco, and Liberia, and the people of the first three are not negroes.

To one who has wandered about in Africa and realized that mission schools, Standard Oil, and Singer sewing machines are there the only reminders of the existence of an American republic, Liberia is a startling change. Elsewhere in Africa the United States is merely a geographical fact, and a fact of no consequence; its currency is good only here and there; its colloquial language is an unknown tongue; its most familiar institutions are as foreign as a Fourth of July celebration in Russia.

But sit with me on the balcony of the American Legation in Monrovia and remember that you are in Africa. This little capital, like the Monroe Doctrine, bears the name of a president of the United States. This main street, the Pennsylvania Avenue of the capital, has the name of Ashmun, who lies buried in New Haven, Connecticut. Yonder lagoon, Stockton Creek, which leads into the Saint Paul River, commemorates an officer of the United States Navy. The little strip of land beyond it, Bushrod Island, got its name from Bushrod Wash-

THE SUPREME COURT OF LIBERIA Photo by Edgar Allen Forbes

Chief Justice Roberts (a Georgian) in the center; Justice Tolliver on the right; Justice Richardson (on the left) is also President of the College of Liberia

ington. That building across the street is the "Executive Mansion". Glance at the flagstaff above it—the flag is the *star* and stripes. And where else, on the eastern side of the Atlantic, will you hear men talking familiarly about "the President," "the Senate and the House," and "the Supreme Court"?

All along Liberia's 350 miles of coast and up and down the sluggish rivers the story is the same. You are constantly passing little settlements that bear such familiar names as Virginia, New Georgia, Clay-Ashland, New York, Louisiana, Buchanan, Hartford, Greenville, and Lexington. And if you go ashore at Harper and Latrobe (Cape Palmas), in Maryland County, you can refer to Baltimore without explaining that it is a city in the United States.

And if you stop to talk with Liberians in any part of the country, you learn quickly that these are not the names of a glory that has departed. It is a curious fact that the American spirit is stronger in Liberia than in many parts of the United States itself. I once sat at a banquet given in Cape Palmas by Vice-President Dossen. As the speakers responded to their various toasts, it struck me that a chance listener would have imagined that this was a company of American negroes come ashore from some passing steamer.

Even the houses of the Liberians are different from those of Sierra Leone and other colonies; they are built in the style of the Southern States. Much of the furniture and the clothing and most of the books and papers that you see are from the United States. The filling of an American order requires months of waiting, the cost is higher, and the Liberians are poor people, but they want

Photo by Edgar Allen Forbes

THE LIBERIAN SENATE, IN FRONT OF THE SENATE CHAMBER
The tall man in the center is Vice-President Dossen

DR ERNEST LYON, FOR 6 YEARS AMERICAN MINISTER TO LIBERIA, AND HIS YOUNGEST SON

Photos by Edgar Allen Forbes

MISS ANNABEL LYON, CLERK OF THE AMERICAN LEGATION

She also looks after the social side of the Minister's household

what they want when they want it. Few of them have even seen or ever expect to see the United States, but they like to feel that they are still a part of America.

I shall not soon forget a feeble, gray-haired negro who hobbled up the steps and held out a hand that trembled with excitement. "I seed you on the porch," he said, apologetically, with that old-time negro deference, "an' I knowed you wuz sum o' mine—an' I'm some o' yourn." And I should like to remark right here that the negroes of Liberia are as polite and respectful to the white man as they are in Kentucky.

Photo by Edgar Allen Forbes

THE HOME OF THE AMERICAN LEGATION IN MONROVIA

It is owned by a negro farmer who left the United States as a freed slave-boy

It is sometimes overlooked that Liberia is one of the most interesting colonial experiments of modern times. There are three cities on that death-inviting West Coast that were founded as homes for returned slaves — Freetown, Libreville, and Liberia—all with prefixes meaning "free." Freetown was taken over by the British Crown more than a century ago because it then had the only safe harbor on the entire coast. Libreville went the same way when French imperialism awoke, and it is now the capital of the French Congo. Only Liberia remains free.

Wholly apart from our own connection with the establishment of the colony, it is interesting to read the declaration of independence of 1847.

"The western coast of Africa was the place selected by American benevolence and philanthropy for our future home. Removed beyond those influences which depressed us in our native land, it was hoped we would be enabled to enjoy those rights and privileges, and exercise and improve those faculties which the God of nature has given us in common with the rest of mankind.

"Under the auspices of the American Colonization Society, we established ourselves here, on land acquired by purchase from the lords of the soil. . . .

"In coming to the shores of Africa, we indulged the pleasing hope that we should be permitted to exercise and improve those faculties which impart to man his dignity—to nourish in our hearts the flame of honorable ambition, to cherish and indulge those aspirations which a beneficent Creator hath implanted in every human heart, and to evince to all who despise, ridicule, and oppress our own race that we possess with them a common nature, are with them susceptible of equal refinement, and capable of equal advancement in all that adorns and dignifies man. . . . Thus far our highest hopes have been realized."

"Thus far"—but that was 63 years ago. The agitation that preceded the Civil War came upon us then and the little African republic dropped below the horizon, there to maintain its struggle as best it could. What about its "highest hopes" today?

This was the question in my mind as I looked one night upon the dark outline of Cape Mesurado and waited on shipboard for the dawn. With eager interest I went ashore next morning, curious to see how the little experiment had turned out, and curious, as a Southern man, to see how the negro type had been affected in the second and the third generations.

Perhaps I should say frankly that I had gone to Liberia with the understand-

THE RESIDENCE DISTRICT OF MONROVIA

Photos by Edgar Allen Forbes

YOUNG OFFICERS FROM THE U. S. S. "CHESTER" ASHORE AT SIERRA LEONE

Photo by Edgar Allen Forbes

ONE STAGE OF LIBERIA'S WELCOME TO THE AMERICAN COMMISSIONERS
The men in uniform are local militiamen

SCENE IN A LIBERIAN VILLAGE

Photo from Captain Cloman, U. S. A.

LIBERIAN GUARDS AT U. S. LEGATION, MONROVIA

ing that it was the final, unmistakable evidence of the black man's inability to govern himself. Being familiar with the negro and his traits, it did not take long to grasp the significance of Monrovia. Since the freshness of those first impressions was lost in the intimate observation of the more stirring events that came afterward, I cannot do better than put down here what I wrote at the time.

There is much about Monrovia that reminds me daily of home, more particularly of my earlier home in the South. I see no real difference between the people of Monrovia and those of the same race in the United States. Even their shortcomings are homelike.

The capital presents from the ship's deck an aspect of quiet civilization that is in marked contrast with the clusters of thatch-roofed huts on the islands near by. The main street is lined with attractive cottages having large porches and balconies, with the Executive Mansion facing an open square. Beyond is the residence district—streets of frame cottages of which an English writer remarks that there is nothing like them to be seen anywhere else in Africa. The general average is about that of the homes of the most prosperous negroes in America.

The people of Monrovia look, dress, and act very like the better class of negroes of Atlanta or Louisville. All the Americo-Liberians (and many civilized natives) are neatly but not flashily clothed, and most of the aborigines put on an extra cloth when they come to town. I doubt if there be anywhere in the United States a negro community of the size of Monrovia where there is so little boisterousness, profanity, and indecency. Swearing is a lost art, and I saw but one case of drunkenness during my first month in Monrovia.

The Liberian Sundays suggest the quiet of a New England city—a quiet that is broken only by the sound of church organs and congregational singing. The churches are well attended, and the services are conducted with due regard to dignity and reverence. There appears to be a complete absence of the American saloon, of the degrading concert hall, and of the negro "dive." The Monrovian may not be a paragon of virtue and sobriety, but he is certainly a decent citizen.

It is well for Americans to know—and I say this with regret—that information about Liberia is not to be trusted if it come from European sources. There are some English gentlemen, for instance, who have had an object in persuading the outer world that the negro republic

THE RESIDENCE OF SENATOR S. G. HARMON AT GRAND BASSA
Senator Harmon is one of the wealthiest of the Americo-Liberians

SENATOR HARMON (IN THE CENTER) ENTERTAINING THE OFFICERS OF AN ENGLISH STEAMER

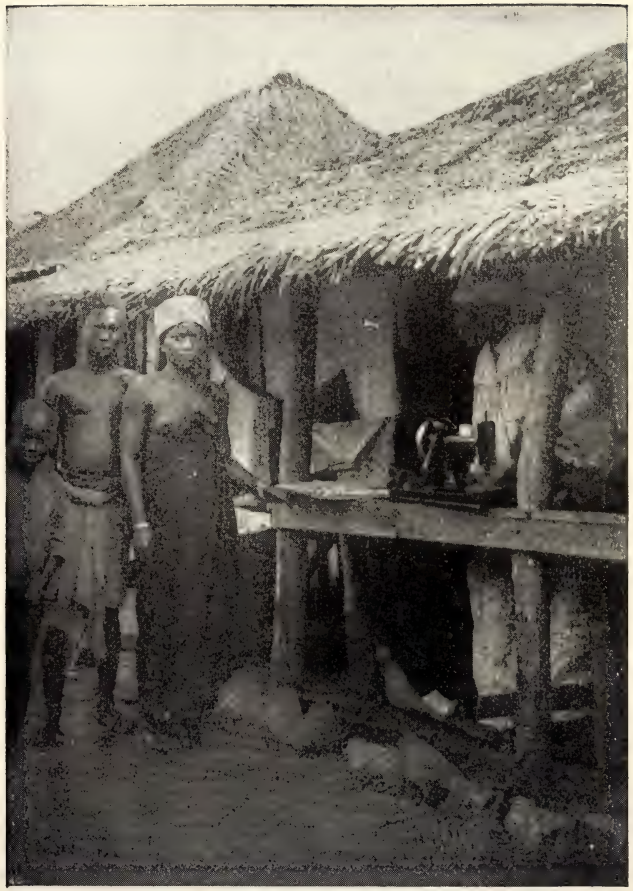


Photo from Captain Cloman, U. S. A.

VISITING A NATIVE TAILOR SHOP: LIBERIA

Note the sewing machine

Photo by Edgar Allen Forbes

TWO DESCENDANTS OF LIBERATED CONGO SLAVES: NEAR MONROVIA

was tottering on its last legs into anarchy and ruin.

Take just one example out of many that I could give. The leading merchant of Grand Bassa was expecting an important shipment of merchandise from Liverpool. The steamer that carried me into that port was expected to bring the goods. Instead the merchant received a letter from the Liverpool shippers saying that they deemed it inadvisable to fill his order until Liberia recovered from its turbulent condition. Now, to my knowledge, the whole land was as calm as Toronto on a Sunday, so I inquired into the cause of the Liverpool rumor.

And this was the cause: a delegation of dissatisfied farmers from some of the settlements up the Saint Paul River had come down to Monrovia, marched in orderly procession to the Senate chamber, formally petitioned that body to impeach President Barclay, and then quietly dispersed. It was the "tamest" sort of a political demonstration. I saw a larger one, gotten up by the opposite party to counteract the effect of the first, and it was about as tumultuous as a parade of the Order of the Eastern Star. Yet the British consul general cabled to Europe that Liberia was in a state of wild disorder and that the government was in imminent danger of being overturned.

Nobody outside of the British diplomatic service knows whether the fault lies with the Foreign Office or the Colonial Office, or with both, but nearly every foreigner in Liberia (except the English) will tell you that some one has unquestionably had a dream of seeing the English flag flying over the Executive Mansion in Monrovia.

Everybody knows how easy it is to lend money to a negro; knows also that the lending of money is a popular way that Europe has in playing the game of grab. In 1871 some bankers of London floated a loan of $500,000, with the export duty on Liberian rubber as security. Sir Harry Johnston, being an Englishman, cannot be accused of exaggeration when he says in his book that there was so much fraud in the transaction that $200,000 is a fair estimate of the money that actually reached Liberia.

Some later historian will show, in a similar way, how another British company defrauded Liberia in the loan of 1906 for another half million. The financial result of these two transactions is that, from two loans amounting to about half of Liberia's public debt today and on which the country is regularly paying interest to the British, the republic has very little to show. But the financial result proved to be unimportant as compared with the political result.

Here is what I found on arrival at Monrovia: British officials sitting at the receipt of custom; British army officers in command of the only regular troops; a British naval officer commanding the only gunboat; a British consul general dictating peremptory dispatches to the Liberian government after the fashion of Lord Cromer in Egypt.

CONDITIONS IN LIBERIA

Notes from the Report of the Recent Commission to Liberia—Messrs Roland P. Folkner, George Sale, and Emmett J. Scott

THE commission was impressed with the dignity and intelligence of the representatives of the government with whom it had dealings. Though these were relatively few in number, they represented the best of Liberia's citizenship, and the fact that the best men find their way into public employment is itself a favorable circumstance.

The Liberians are not a revolutionary people. Since the beginning of their

A SMALL PART OF THE METHODIST MISSION AT GARRAWAY Photo by Edgar Allen Forbes

Where Miss Anna E. Hall, of Atlanta, is directing one of the most successful tasks in the whole country

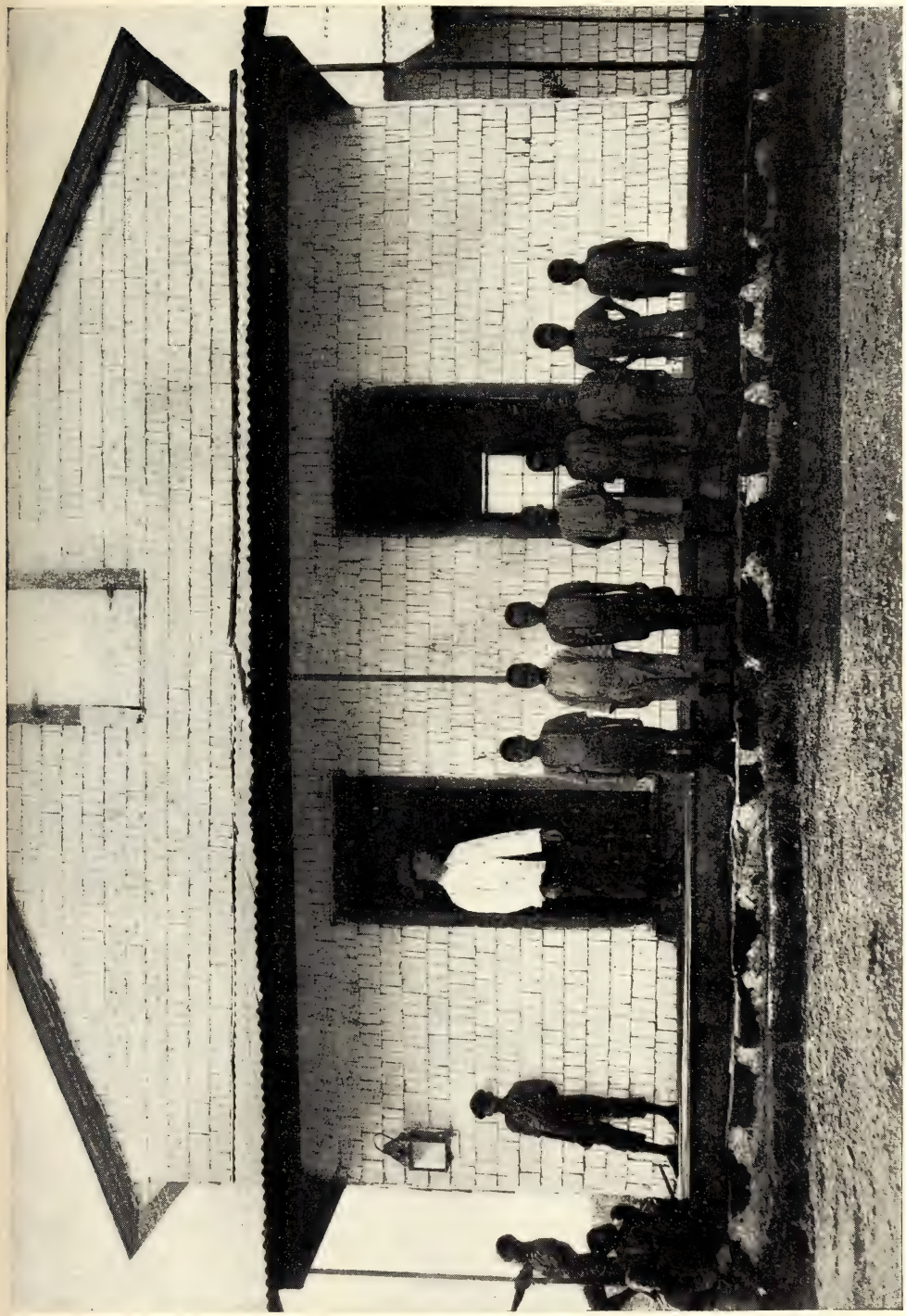


Photo by Edgar Allen Forbes

EIGHT SONS OF ONE NATIVE KING, IN THE LUTHERAN MISSION SCHOOL AT MUHLENBURG, LIBERIA

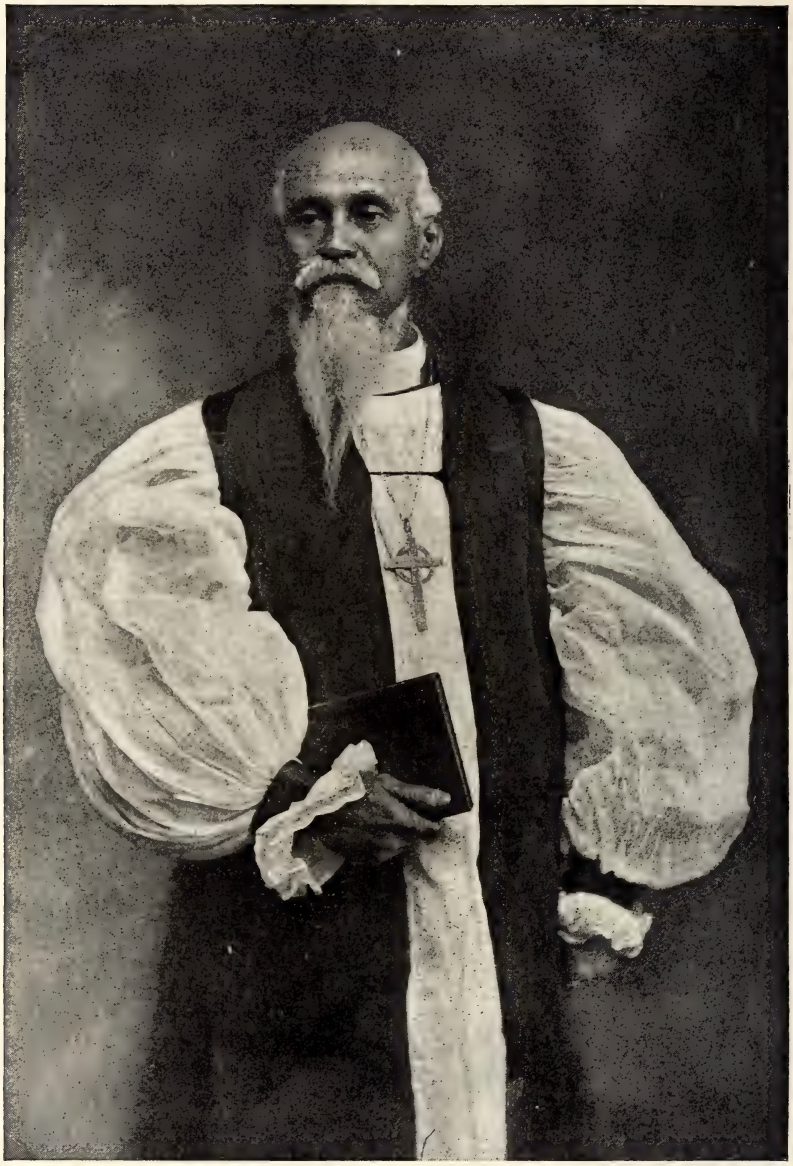


Photo by Edgar Allen Forbes

THE RT. REV. S. D. FERGUSON, EPISCOPAL BISHOP OF LIBERIA

He is a South Carolinian who has spent almost his entire life in Liberia. Although now advanced in age, he is extremely active and has a firm grip on his work. He has trained up a fine body of native clergymen.

national life they have maintained the forms of orderly government. In 62 years they have had 13 presidents, most of whom have been re-elected for one or more terms of two years each, and when changes of administration have been sought they have been sought by constitutional means. While under stress of public opinion one or more presidents have resigned their office, impeachment has been resorted to but once, and revolution not at all.

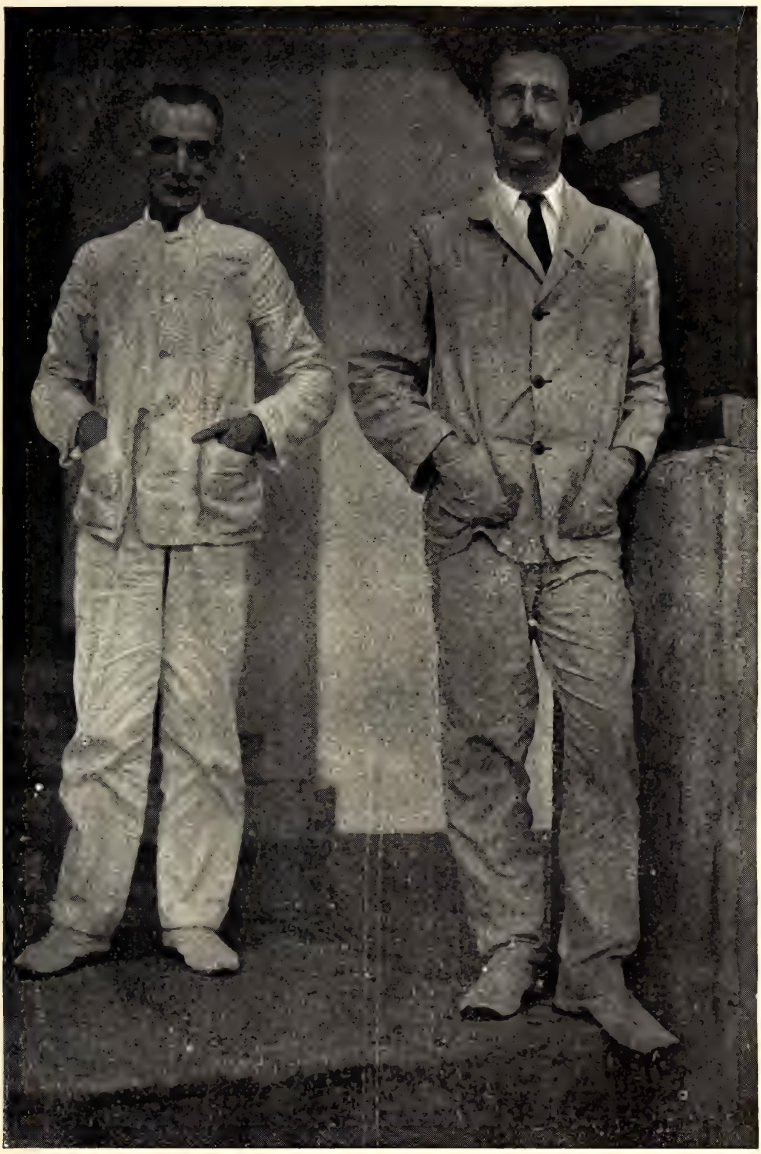


Photo by Edgar Allen Forbes

RECENT BRITISH REPRESENTATIVES IN MONROVIA
The gentleman on the right is Captain Braithwaite Wallis

Despite frequent assertions to the contrary, Liberia is not bankrupt. Much that is crude was discovered in the administration of the fiscal affairs of the republic. The government is embarrassed by its indebtedness and the burdens which it entails. But the national debt of less than $1,300,000 is not excessive, even if we compared it with the present revenues. In contrast to the natural wealth of the country, it is very small. Liberia is not a failure in self-government. It is true that the effective government of the country extends only to

Photo by Edgar Allen Forbes

GROUP OF OFFICIALS ON THE OCCASION OF THE VISIT OF THE GOVERNOR GENERAL OF FRENCH WEST AFRICA TO LIBERIA

the coast towns and settlements along the rivers Saint Paul and Saint John, but in these towns and settlements law and order prevail, life and property are adequately protected, and crime is promptly punished. Peace, good-will, and friendly feeling prevail between these towns and settlements and the native villages immediately adjacent to them.

However crude in many respects the civilization of Liberia may be, the Liberians have advanced, not retrograded, in their civilization. In estimating the progress of the Liberian people it is well to bear in mind their origin. The original elements of the population of Liberia were three: Free negroes sent out by the Colonization Society; Africans rescued from slave traders by the United States war vessels during the period of the suppression of the slave trade; freedmen who emigrated to Liberia since the war.

Out of these materials, guided by the traditions of life in America, the Liberian people have developed a civilization that compares not unfavorably with the better element of the negroes in the United States. It was the conviction of the commission and their associates that the Liberians had influenced the native population by which they were surrounded far more than the natives had influenced them. In the presence of that great mass of uncivilized people they have maintained a relatively high degree of civilization, of which the well-ordered home, the maintenance of law and order, the quiet Sunday rest, and the well-attended houses of worship are conspicuous signs.

It is the larger and more difficult tasks of government which now confront Liberia, chiefly as a result of the partition of Africa by European powers during recent years, which Liberia finds too hard for her. They grow out of the increasing importance of her relations with neighboring countries and the urgent necessity of more effective control and government of the native tribes within her boundaries. It is with reference to these tasks and problems growing out of them that Liberia feels the need of help from a strong power.

Photo from Captain Cloman, U. S. A.

RESIDENTS OF A VILLAGE NEAR MONROVIA

Specifically these problems are:

1. The maintenance of the integrity of her frontiers in the face of attempted aggressions of her neighbors, against whose might she can oppose only the justice of her claims.

2. The effective control of the native tribes, especially along the frontiers, so as to leave no excuse for the occupation of her territory by her neighbors.

3. The systemization of the national finances so as to render certain the meeting of all foreign obligations and to establish the national credit on a firm basis.

4. The development of the hinterland in such a way as to increase the volume of trade and thus supply the resources necessary for the increasing wants of a progressive government and at the same time enable the government to offer in-

CELEBRATING A HOLIDAY ON THE STREETS OF ACCRA, THE CAPITAL OF THE GOLD COAST COLONY

The Gold Coast, an English colony on the West Coast of Africa extending along the Gulf of Guinea, was discovered by the Portuguese in 1470, taking its name finally from the valuable deposits of gold discovered. This country, rich in gold dust, rubber, palm oil, and ivory, has a soil of great fertility, magnificent mahogany and palm forests, but to the white man a climate decidedly unhealthy. Coming down through the centuries this territory

A NATIVE KING AND HIS COUNSELLORS

The coast line of the Gold Coast extends 350 miles, bounded on the north and west by the French territories and on the east by German Togoland, the total area being about 72,500 square miles. Of the many native tribes governed by their kings, the warlike Ashantis and the crafty Fantis stand out; the Ashantis, born fighters, have battled with the English for every foot of their country, and were not finally crushed until 1900. The capital and seat of government is Accra, with a population of about 30,000, the chief port of the eastern part of the coast; the other large towns are Elmina and Cape Coast Castle. The estimated native population of the colony is 1,500,000, with a very small percentage of whites.

A NATIVE KROO WOMAN IN LIBERIA

ducements to desirable emigration from the United States.

Because Liberia has thus far failed in solving these problems satisfactorily she has found herself involved in controversies with foreign nations. These have created an unrest which hampers her internal development and have made her feel that her national existence is threatened by powerful neighbors without and by weakness within.

BOUNDARIES WITH FRANCE

To the north and east Liberia has France as her neighbor. In pursuit of their policy of building up a great West African empire, the French have been a thorn in the side of Liberia. They have

been consistent and persistent in their efforts to increase their boundaries. By successive treaties with Liberia they have deprived that country of territories long claimed by her. France has based its aggressions on the plea that the territory which she had annexed, and then had ceded to her by treaty, was not effectively occupied by the Liberians, and was therefore subject to acquisition by another power.

On the west Liberia adjoins the British colony of Sierra Leone. Even while Liberia was still a colony under the governors appointed by the Colonization Society she had trouble with Sierra Leone. British traders contended that Liberia had no right to impose customs duties, and refused to recognize her authority in this regard. The question thus raised was one of the main considerations which led to the formation of the republic.

Since Liberia has been an independent nation it has at several junctures been forced to make concessions to the ambitious designs of her neighbor. It is enough to recall the long dispute respecting the west boundary of Liberia, which was finally settled by the treaty of 1885, negotiated in its final stage at the cannon's mouth, whereby Liberia lost to Sierra Leone a considerable coast line to which she had an equitable claim.

The British Foreign Office has protested that Great Britain has no designs on Liberian territory. We find it hard to reconcile this protestation with the acts and attitude of her officials in Sierra Leone and Liberia. Certainly there is no difficulty in understanding Great Britain's declaration that if France is permitted to make successful advances into Liberian territory she will be compelled in her own interests to claim her share.

It makes little difference whether Great Britain is the upper or the nether millstone. Liberia is between the two, and it is the conviction of the commission that unless she has the support of some power commensurate in strength with Great Britain or France, she will as an independent power speedily disappear from the map.

The public schools of Liberia include Liberia College, in Monrovia, for higher education, four feeders or intermediate schools between the college and the lower schools, and the common schools. The college lacks the barest necessities in the way of equipment, and its courses of study scarcely equal those of a high school. The intermediate and common schools suffer for want of school-houses and efficient teachers. Annual appropriations for the support of schools are very small and are paid with much uncertainty. A radical reconstruction of its schools is one of Liberia's greatest needs. So long as the appropriations continue what they are, there can be little hope of the development of a proper system of public education. And so long as the revenues of the country are not materially augmented, there is little prospect that the republic will be able to make larger appropriations for this service. The best educational effort in the country is at the present time under church auspices, and some of the schools maintained by religious organizations are commendable.

Liberia's great source of wealth is her forests, which yield her palm oil, palm kernels, piassava fiber, and rubber. The gathering of these products is the work of natives, who sometimes labor under the direction of the Liberian, but more frequently barter the results of their independent toil with the Liberian or direct with the foreign merchant. Liberia fails to realize the full value of what she exports, because crude and wasteful methods of gathering these products and preparing them for the export trade deprives them of a part of their value.

The chief agricultural export of the Americo-Liberians is coffee. At one time the coffee industry was in a very flourishing condition, but is now stagnant or retrograde. The competition of other countries, notably of Brazil, which has brought to the world's market cheaper and better prepared coffees, has brought discouragement to the Liberian planter,

whose tiny crop no longer brings him those excellent prices which once rewarded his industry. He has grown listless and careless. He has not studied to adapt himself to the new conditions, and continues to cultivate and harvest the old crop in the old way.

The situation of coffee-growing outside of Brazil is far from hopeless, but planters elsewhere must be content with smaller profits than before and must meet the Brazilian competition by placing their product on the market in the best possible shape. Crude and antiquated processes prevail in Liberia, and it has done little to meet these conditions.

Liberia has little more than scratched the surface of its soil in a very small portion of its area. While not an extensive country, it is very inaccessible for lack of proper means of communication. Rivers are navigable for a short distance from the coast only before rapids are reached; rough roads in the civilized settlements and forest trails and paths in the interior country are the only avenues of communication. Wheeled vehicles are almost unknown, and, except for some water transport as the coast is neared, all the trade which flows from the interior comes upon the backs and heads of native carriers.

This woeful absence of means of communication restricts greatly the area in which trade can originate, as well as minimizes the influence of Monrovia in the interior and presents great obstacles to the effective control of interior points.

The difficulties of communication in the interior do not result from the topographical configuration of the country, but rather from the absence of highways through the forest country. As a result, the interior of Liberia is as little known to the Liberians themselves as to the world at large. What its extensive forests may be able to produce, what stores of wealth lie hidden in them, what value the cleared land would have for agricultural purposes they simply do not know.

A still further difficulty in the way of Liberian commerce is the want of harbors and the consequent difficulties of shipping goods. When produce has with great labor been brought to the coast towns, there still remains the task of shipment. This, on account of the shallow water on the bars at the mouths of the rivers, is a costly and often dangerous task.

There is every reason to believe from the natural fertility of the soil and the luxuriance of its vegetation that the country has great possibilities. But a more accurate knowledge must be had before they can be developed into fruitful sources of national wealth.

To the difficulties here enumerated must be added the lack of interest in industrial pursuits. The people are largely engaged in governmental and commercial pursuits. Trades and industries languish. Most of the skilled workers in Liberia are said to be from Sierra Leone. Nearly all manufactured articles are imported. While Liberia will never perhaps become a manufacturing country, greater attention will be necessary to the development of trades and industries before a high order of national thrift can be secured.

In the present economic condition of Liberia the commission is quite unable to recommend to the American negro any extensive emigration to that country. It believes that there is a field there for a large body of civilized negroes, but is equally certain that under existing conditions the emigrant who carries thither little beside his physical strength and his willingness to work out his own salvation would encounter little but hardship at the outset, and but a slim prospect of founding a comfortable economic existence for himself and his family. Liberia has much to do before it can offer tempting prospects to the would-be settler.

Its laws concerning immigration are fairly liberal and fairly intelligent. But its execution of the laws has fallen into disuse. One can imagine no greater embarrassment for the Liberian authorities than the unannounced arrival on their shores of a company of 200 or 300 immigrant laborers. If we can trust the statute books, land they have in abun-

dance, but it is unsurveyed, it is inaccessible for lack of roads, and covered with a dense forest growth.

The Liberians know too little about their own country and understand too little how to develop its resources to be able to render any assistance to immigrants. A systematic study of the resources of the country; a knowledge of its products and the best methods of gathering them; a knowledge of the possibilities of its land and how it can best be brought under cultivation; the construction of at least one good road into the interior, where better lands and more salubrious climate for man and beast are found—all these are necessary before Liberia can begin to offer inducements to immigrants. Liberia has neither the means nor the knowledge to enable her to prosecute such an effective study of her own country. No greater service could be rendered than to undertake for her such a study of her country as would enable Liberia to find herself economically, to enter into her own heritage, and to open hospitable doors to desirable immigrants from the United States.

Among its recommendations, the commission urges that the United States should establish and maintain a research station in Liberia.

The object of such station should be the scientific research of the natural phenomena of the country, the development and preservation of its sources of wealth, the effect of climate on health, and the causes, treatment, and cure of tropical diseases.

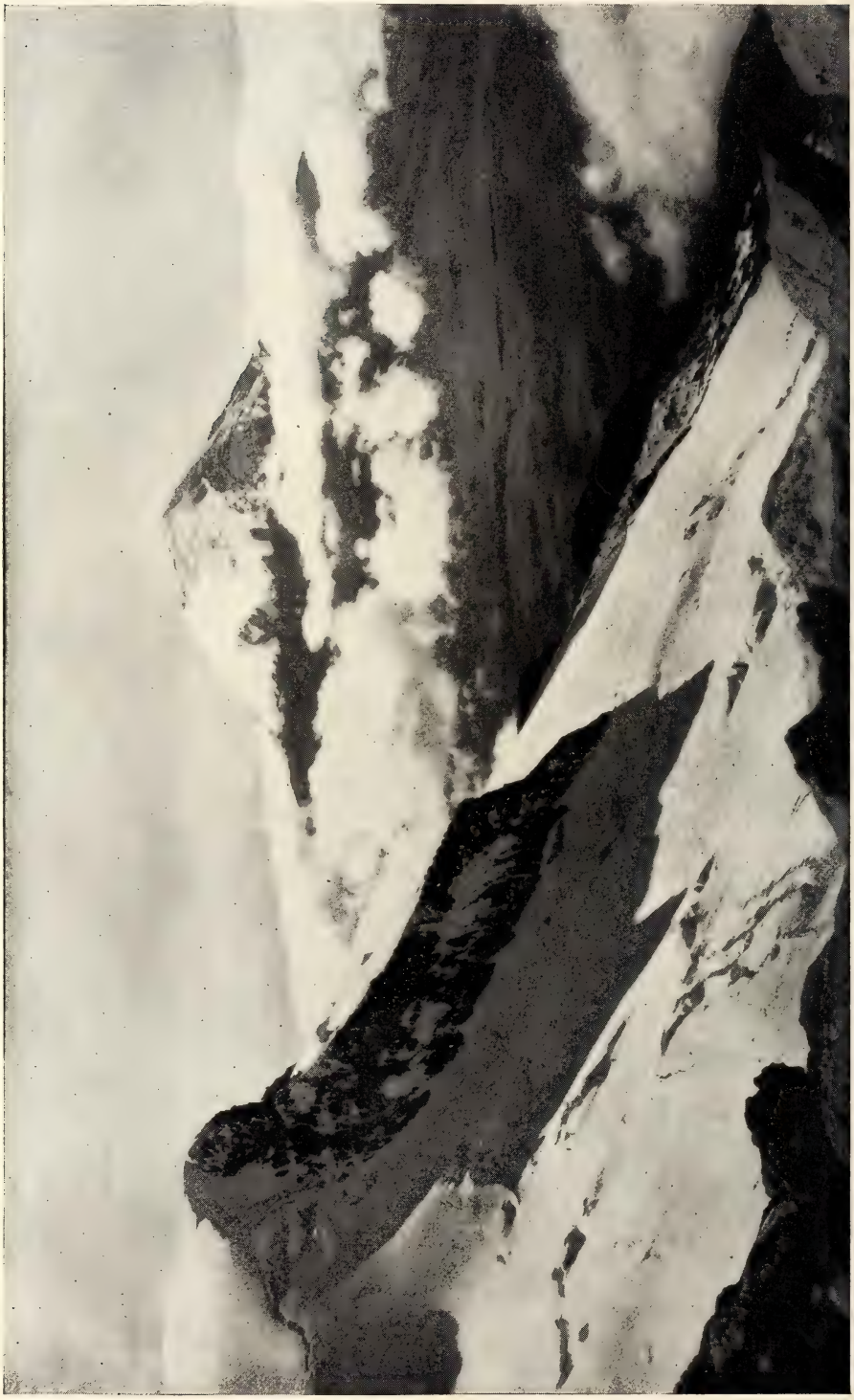
The United States has already in its brief career in the tropics made researches and discoveries which have enriched the world's knowledge of tropical conditions. It is to be anticipated that were a well equipped station established in Liberia, there would be further fruits of research which would redound to the credit of the United States. It would afford to the American student an opportunity for study of the natural products of the continent of Africa in one of its least explored and probably richest parts.

Nor is it to be overlooked that such a station would in a few years acquire a vast store of information for the instruction and direction of immigrants from the United States. Under favorable conditions Liberia can offer great advantages to our negro fellow-citizens. Until, however, the necessary information regarding the country can be placed before would-be immigrants in some systematic and effective way, attempts on the part of American immigrants to make a home in Africa must be attended with great probability of disaster.

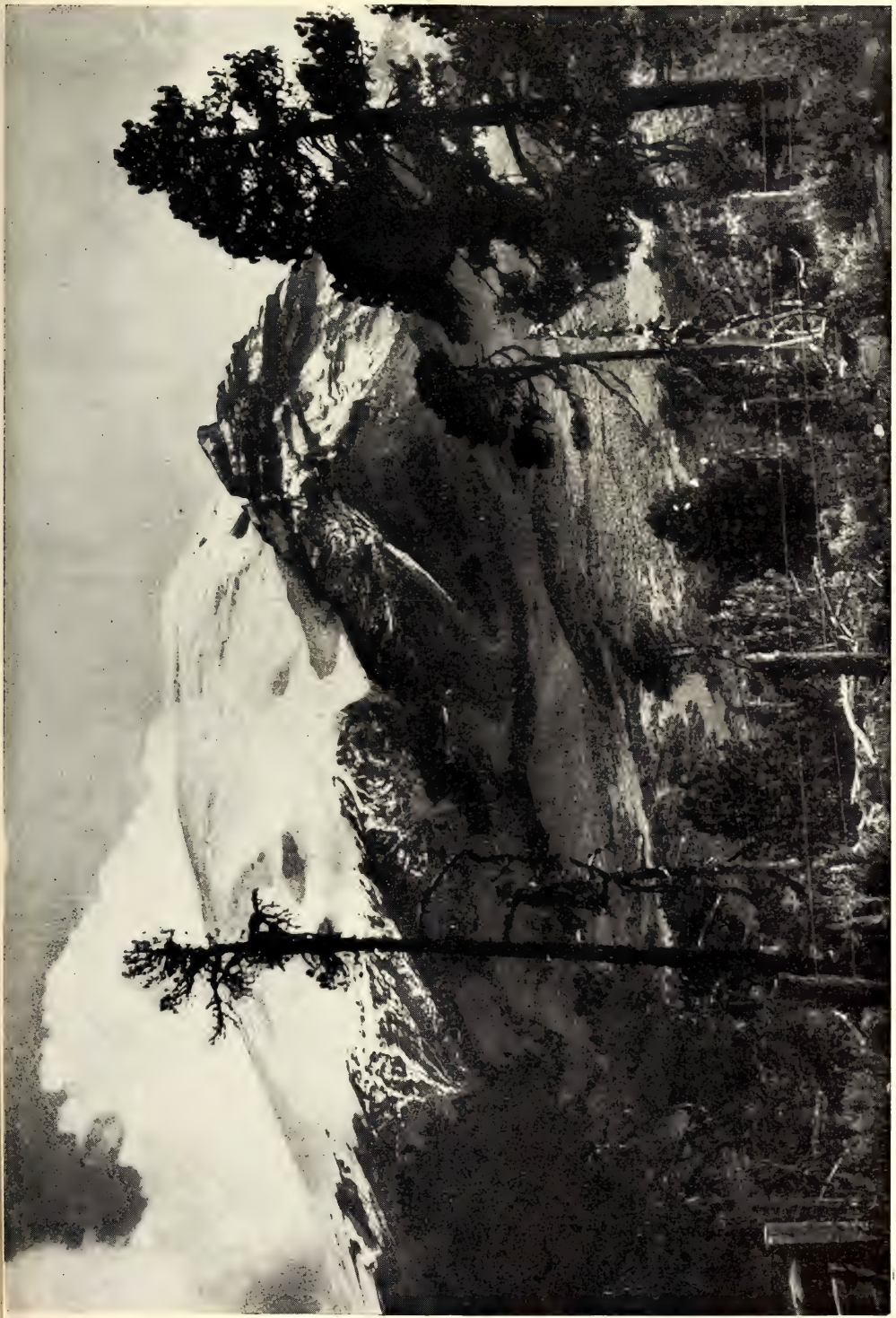
THE GREATEST VOLCANOES OF MEXICO

With Text by Mr A. Melgareio, of Mexico City, and Photographs by S. L. Wonson, of Boston

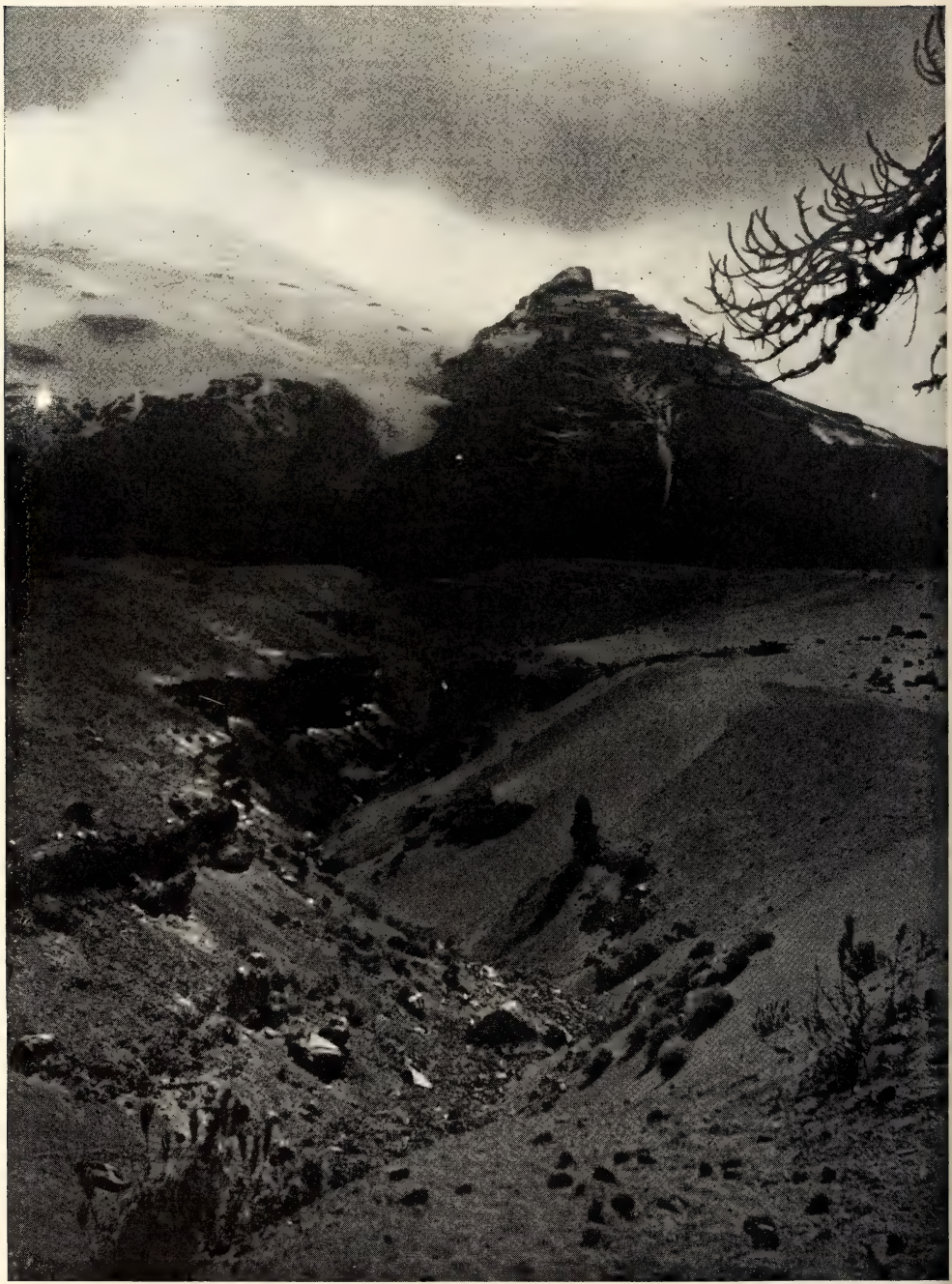
POPOCATEPETL, the "Smoking Mountain" of the Aztecs, has only one superior in height on the North American continent—Mount McKinley, in Alaska—and only one rival, Mount Orizaba. In beauty it has few equals on earth. The Alps, the Himalayas, the Andes, and other of the great ranges present, without doubt, peaks of great beauty or peculiar formation, but few show the charming contrast of landscape peculiar to Popo, as the mountain is known locally. Its well-wooded slopes and foothills, the cultivated plains at its feet, with their patches of mellow green and yellow, its ravines and canyons and the lakes below are like a frame to its immense cone of reddish rocks, black sands, and its beautiful cap of white. The many towns and ranches around it and the railroads running at its base give it a peculiar "homelike" look, much dif-



NO. I. POPOCATEPETL, "THE SMOKING MOUNTAIN" OF THE AZTECS



NO. 2. VIEW OF POPOCATEPETL FROM THE HALF-WAY HOUSE



NO. 3. THE FRIAR PEAK OF POPOCATEPETL

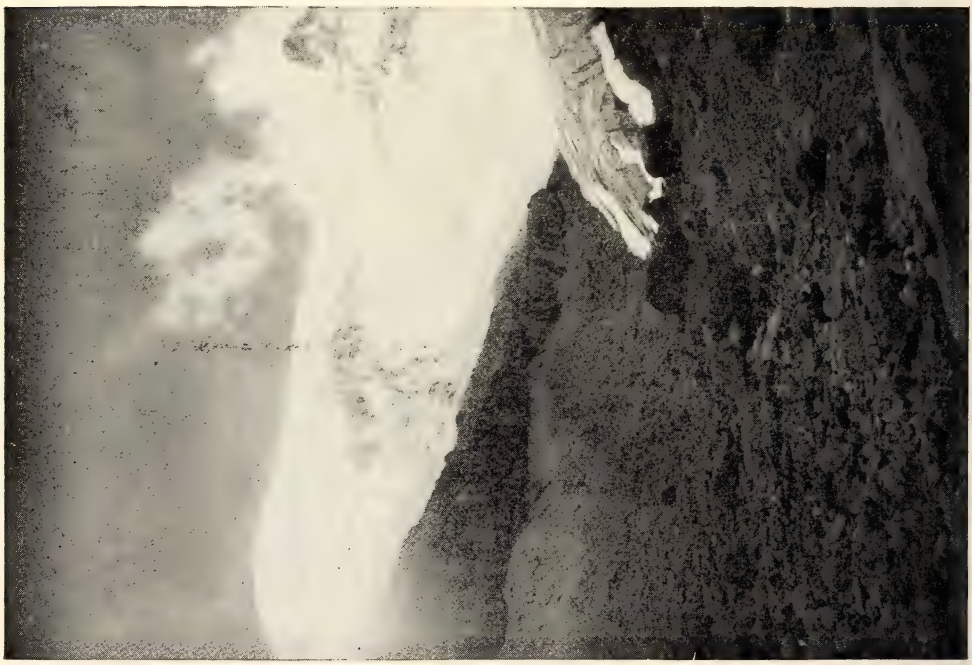
NO. 4. THE VERTICAL WALLS OF THE IMMENSE CRATER OF POPOCATEPETL

The crater is more than one-half mile wide and one-half mile deep

NO. 5. "THE WOMAN IN WHITE"

NO. 6. VIEW OF "THE WOMAN IN WHITE" FROM THE RIM OF POPO'S CRATER

NO. 7. THE STEEP SLOPE OF IZTACCIHUATL



NO. 8. THE CRATER OF IZTACCIHUATL

NO. 9. THE PICTURESQUE COSTUMES OF THE GUIDES

ferent from the majestic wilderness of the average large mountains.

Easily accessible, it is often climbed. It is only a pity that lack of enterprise should so far have prevented the building of observatories at its summit, or even proper accommodations at its base for the mountain climbers.

Photo No. 1. Popocatepetl, with a heavy mantle of clouds, as seen from the summit of Iztaccihuatl. The opening of Popo's crater is plainly visible.

Photo No. 2 of Popocatepetl, 17,520 feet high, was taken from the half-way house, at Tlamacas ranch, at an altitude of about 11,500 feet. The peak on the right, "El Fraile," is about 15,000 feet high. Its brick-red, vermilion, and black rocks contrast with the glistening white cone above and the slopes below, which, covered with a layer of many feet in thickness of fine volcanic dust of a grayish black, give the mountain a quaint "velvet" look.

The half-way house, now an abandoned shack, some 25 years ago served as a storage house for the sulphur smelter installed at this point. All sulphur taken from the crater at that time was refined here, being native and of easy treatment.

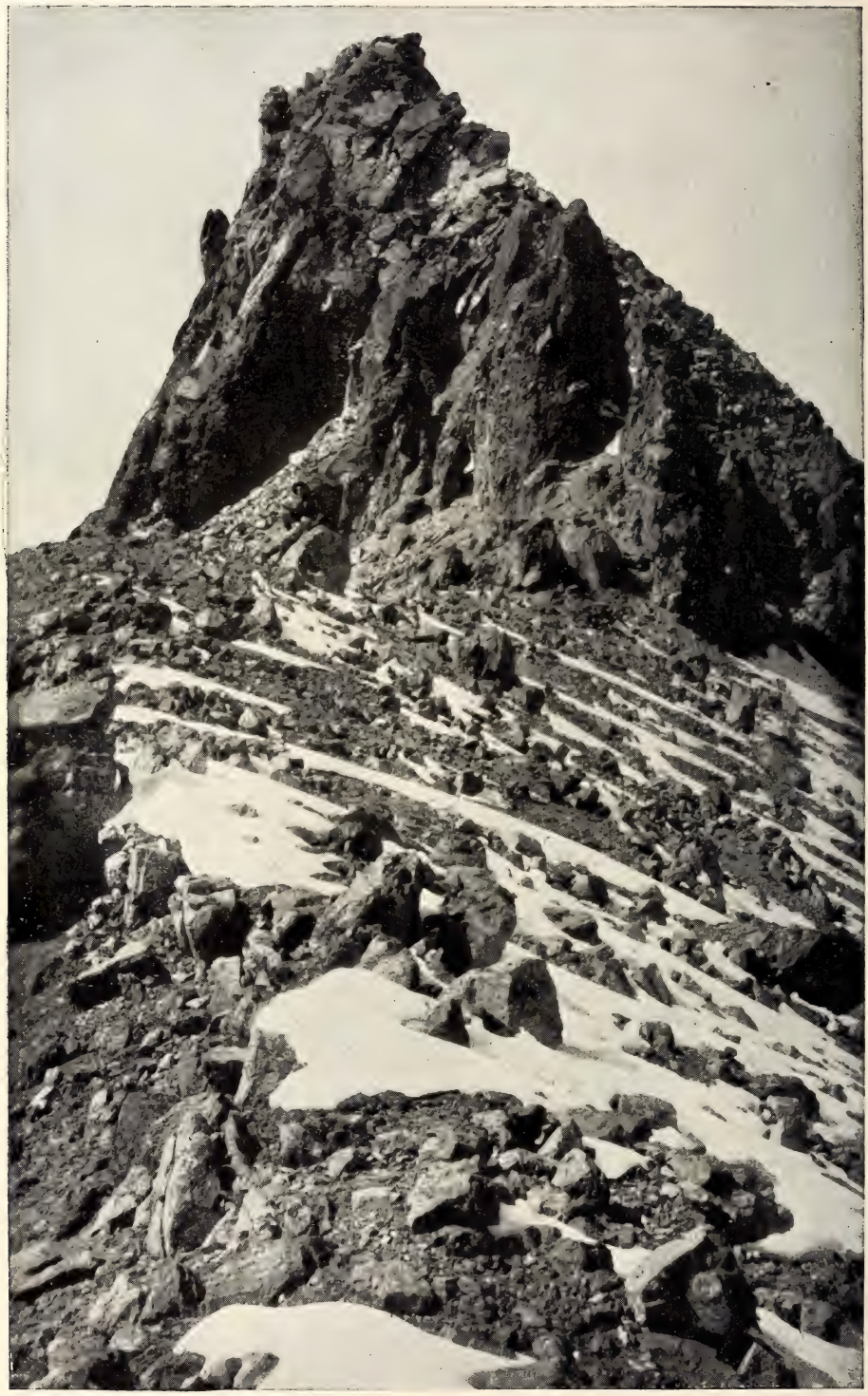
Photo No. 3. "El Fraile" (The Friar) peak. About 15,000 feet. It offers opportunity for the most difficult alpine climbing. Below is seen the beginning of a great gulch, showing on its sides the extremely fine volcanic dust.

Photo No. 4. The south and western walls of the crater of Popo. The highest point shown on the left is the summit of the mountain, 17,520 feet above sea-level. Along these walls are numerous steam vents. At the foot of the walls on the eastern side are located the sulphur vents, from which thick white sulphur smoke constantly issues, and whence the native sulphur is taken. The crater, from the highest point seen to where the camera stood, its widest part, is estimated to be over 2,700 feet in diameter, being almost round in shape. Its depth to the lowest point visible is about 900 or 1,000 yards.

NO. 10. THE VOLCANO OF TOLUCA, OR "THE NUDE MAN"; NOTE THE HUGE CUP OR CRATER

NO. 11. VIEW OF THE GREAT CRATER OF TOLUCA

NO. 12. THE LAKE IN THE CRATER OF TOLUCA



NO. 13. THE HIGHEST PEAK OF TOLUCA

NO. 14. THE WHITE SURFACE IN THE FOREGROUND IS NOT WHITE, BUT SULPHUR CRYSTALS: ORIZABA

Photo No. 5. Iztaccihuatl, "The Woman in White," is the fitting companion of Popo. Its resemblance to a human form is remarkable, and the rugged, abrupt sides are in marked contrast with the graceful lines of the snow-covered body. It is located about 10 miles directly north of Popo and about 40 miles east of the city of Mexico. It rises to 15,082 feet above sea-level at its highest point, being, as will be seen from the above photograph, oblong in shape. Amecameca, the base of supplies, where horses, guides, etc., are obtained, and from where the start for the climb to both Popo and Iztaccihuatl is made, is seen in the foreground.

Photo No. 6. Iztaccihuatl, seen from the rim of Popo's crater. What appear like patches of grass on the sides of the mountain are in reality forests of the largest trees.

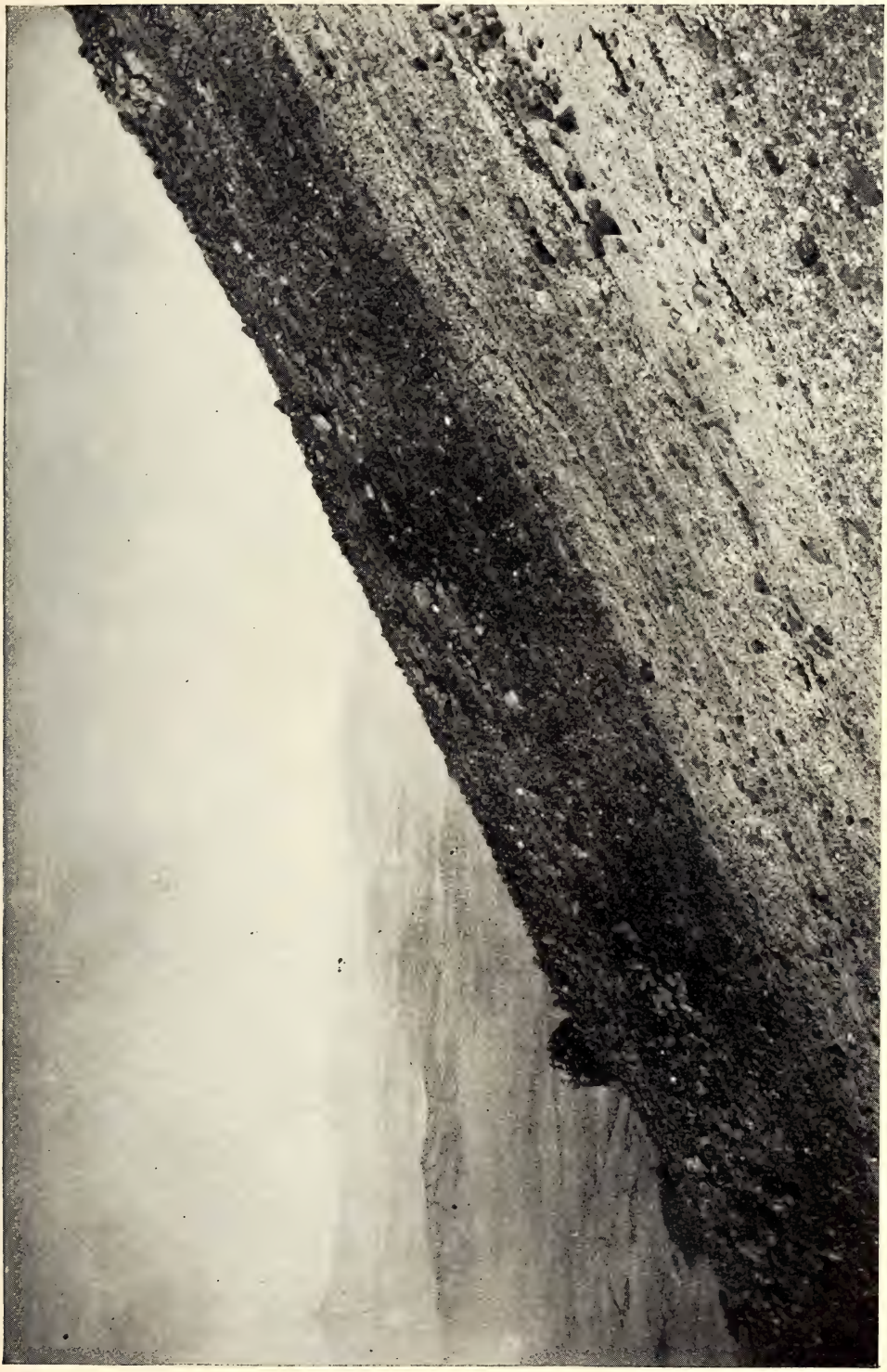
The great superstition of the natives has made them give all the rocks and peaks religious names.

Photo No. 7. M. Rossi and guides. Showing the steep but even slope when heavily snowed.

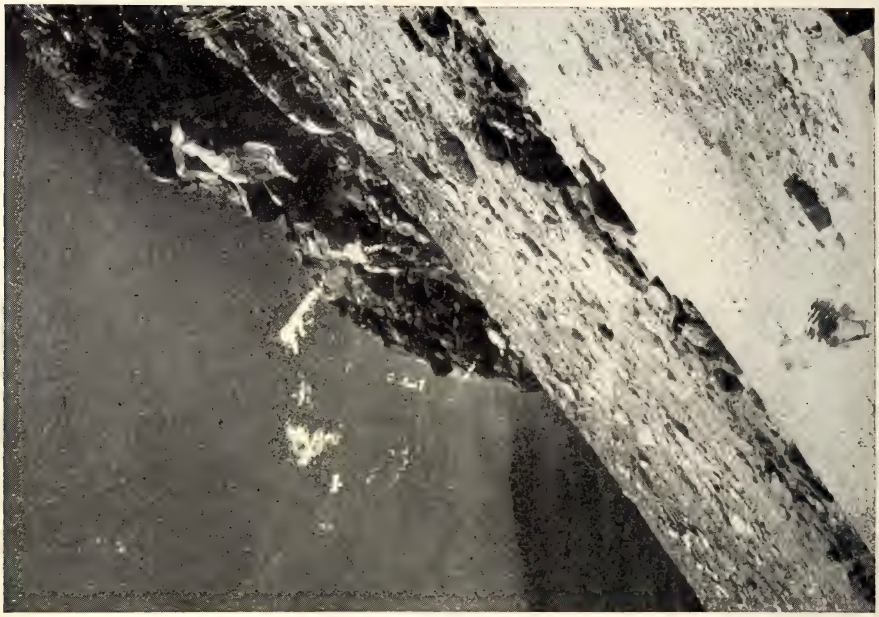
Popocatepetl, although considered an extinct volcano, is in reality only dormant, as is proven by its great sulphur and steam vents. However, its great eruptions date as far back as 1548, and the last were recorded 108 years ago, in 1802. Iztaccihuatl is entirely extinct, its activity having ceased since the 17th century, and it is a matter of doubt whether it was then really active.

The mean altitude of the plains surrounding both mountains is about 7,500 feet, so that their absolute height above the valley is 8,000 feet for Iztaccihuatl and 10,000 feet for Popocatepetl. They form a more or less isolated chain, the so-called valley of Mexico lying on the west and the Puebla Valley on the east. North of Iztaccihuatl the plains are conspicuous, and south of Popocatepetl a great depression occurs, reaching to the "hot country," thus allowing a magnifi-

NO. 15. ORIZABA, "THE SHINING STAR"



NO. 16. VIEW FROM THE SLOPE OF ORIZABA, SHOWING POPOCATEPETL AND IZTACCIHUATL, 20 MILES AWAY



NO. 17. A DIFFICULT PIECE OF ROCK TO BE SURMOUNTED: ORIZABA

NO. 18. THE CRATER WALL: ORIZABA

NO. 19. THE SUMMIT OF ORIZABA, WITH THE CRATER EDGE IN THE FOREGROUND

NO. 20. TYPICAL VIEW OF THE SLOPES OF ORIZABA, BELOW THE SNOW LINE

NO. 21. THE VOLCANO OF COLIMA IN ERUPTION

The heavy clouds seen above the mountain are of smoke issuing from the crater. Photo by De Loe

NO. 22. THE ACTUAL "TOP" OF ORIZABA IS ABOUT 2 OR 3 FEET SQUARE

cent view of both mountains from the lands at an altitude of 5,000 feet and lower.

Photo No. 8. What was presumably Iztaccihuatl's crater, now filled in and covered up. The hump on the left, snow-covered, is one of the "breasts" of the mountain.

Photo No. 9. Mr A. Melgarejo at the snow line, about 13,500 feet. Showing the picturesque but cumbersome costumes of the guides. Under the worst conditions a pick and shovel are sufficient to insure a safe climb.

Photo No. 10. Xinantecatl, "The Nude Man," or Volcano of Toluca, lying about 30 miles southwest of the city of Toluca and about 90 miles west of Popocatepetl. The photograph, taken by Mr S. L. Wonson, shows plainly the great wide crater of the volcano, as well as the limit of vegetation, about 13,000 feet above the sea. The highest peak of this mountain, the dark, sharp peak on the left-hand side of the crater, rises to 15,055 feet. Its well-wooded slopes are magnificent cattle ranges on the side shown and good game preserves on the other side, the whole mountain furnishing first-class timber.

This is one of the oldest volcanoes in existence, there being no record of its eruptions, which, to judge from the size of its crater, must have been terrific. The ascent up to the interior of the crater is extremely easy, being done on horseback from Calimaya, a small town located northeast of the mountain, about 15 miles from the crater.

Photo No. 11. A general view of the interior of the crater. The foreground shows one of the two lakes which the crater contains. The largest of these two lakes lies behind the hill seen in the middle of the crater. On the left, above the snow, appears the highest peak. See photo No. 13.

Photo No. 12. General view of the great lake, which measures about three-quarters of a mile in length by about half a mile in width. Its waters are perfectly clear, and, due undoubtedly to the depth of the crater, as blue as the ocean. This reservoir must, through

its underground ducts, feed a large number of the streams at the base and sides of the mountain. Aside from this rippling lake, there is no sign whatever of life in this immense crater of Toluca.

Photo No. 13. "El Aguila." The highest point on Toluca's volcano, 15,055 feet above sea-level. After a leisurely ride from the plains below, the ascent to this peak is accomplished after a rough scramble of about two hours, its altitude above the level of the lake shown in photo No. 12 being only about 700 to 800 feet.

Photo No. 14. The author and guides at the crater's edge. The ground in front of the group is made of limy material as white as the snow in the background. Here is where the sulphur is picked, the entire surface being covered with layers of sulphur crystals.

Photo No. 15. Citlaltepetl, "Shining Star," or Peak of Orizaba, about 60 miles northwest of Vera Cruz, on the Gulf coast, 18,240 feet above sea-level. Located at the edge of the plateau, it rises 10,500 feet above the plains on the west, its eastern slope, extremely rugged and broken, running all the way to sea-level. All the big ranges being below the plateau, it stands alone with imposing majesty. Its shining cone is visible 80 miles out at sea, long before the land has come into view.

Its crater has the most irregular shape, very broken and jagged, and is smaller in diameter than Popocatepetl's, but about as deep as the latter's. Sulphur appears in crystallized form in layers at the crater's edges mixed with impurities of all sorts. Aside from some small steam vents, the crater shows no signs of life. However, from the fact that the cone is so well preserved and its proximity to the sea, it is not regarded as a dead volcano, but rather as a young one which may yet become active.

This photo was taken from the town of Chalchicomula.

Photos 16 and 20 show the general character of Orizaba on the side where the ascent is made. This being the southwest side, it is exposed to the sun's rays and to the warm south winds, which, melting the snows quickly, cause the running water to undermine the loose rocks, and, due to the great inclination of the mountain sides, these fall continually in avalanches, hewing the mountain. The north side presents the opposite appearance—that of a hump eternally covered with snow, as, due to the geographical position of the mountain, the sun seldom shines on that side. The ascent over these loose rocks is greatly fatiguing and slow.

Photo No. 16, where the arrow appears, on the left, shows Popocatepetl and Iztaccihuatl in the distance, 90 miles away, and to the right, in the center of the picture, Malintzi, about 55 miles distant. The latter is another extinct volcano, 13,510 feet high.

Photo No. 17. "The Pulpit." To attain the crater it is necessary to climb over the rocks seen on the left. These rocks offer a true alpine sport to the ones that conquer the summit.

Photo No. 18. This photograph offers a good idea of the uneven sides of the crater. Beyond the rim, on the opposite side, are seen the hills, the plains, and the sea, the latter being the dark strip beyond the white line marked by the cross on the right. This photograph is unique, showing as it does the height of the mountain above the level of the sea.

Photo No. 19. The Peak of Orizaba. The summit of the mountain and the walls of the crater are plainly seen. Notice the size of a human being, marked by the two arrows on top and to the left, in comparison with the surroundings.

Photo No. 22. The summit. Mr Wonson to the left, Mr Melgarejo to the right, and guides. A large cross, made of iron piping, was erected here by a pious German, but, undoubtedly struck by lightning, it has fallen to the ground in greatly distorted shape. The view obtained from this high point commands a hundred or more miles in every direction. The formation of the high Mexican plateau, the Gulf watershed, and the coast is here plainly seen. As shown by the photograph, the actual "top" of the mountain is about two or three feet square.

THE FRINGE OF VERDURE AROUND ASIA MINOR

By Ellsworth Huntington

WHAT kind of a place is this? Here we've been waiting in Girmeh over an hour and no one will bring us anything, not even bread and grapes and sour milk, although we are willing to pay well for them.

"No good sons of the Prophet would ever treat strangers so. We have traveled many moons in Anatolia and never met anything like it. To whom were you saying your prayers so piously when we arrived? Not to Allah, certainly. You think Baulo is a country place way off in the woods, but there they behaved like good Mussulmans. Here you act like infidels. We'll tell about you at the bazaar, and we'll put you in a book, so that every one will be ashamed to say he is from Girmeh."

Our strictures went home and there were many apologies. "We are poor," they said, "and have nothing to offer to such distinguished guests."

"Poor?" we answered. "Do poor men wear such splendid colored gowns as those which you have on? If you were poor could twenty of you sit around all day under the walnut trees by the fountain at harvest-time with nothing to do but say your prayers? Can men be poor who have such springs of pure water as this, and who own such magnificent orchards and gardens? Look down the mountain-side there and see those vineyards and all the trees. How many kinds have you?—walnut, fig, mulberry, pear, plum, apricot, 'little red' [a kind of bright red acid plum], and a dozen others. And who owns all those wheatfields on the terraces along the mountain slope between here and the pine woods? No, you are not poor, but simply rich and lazy."

"Well," they said, not altogether truthfully, "we might have brought some rugs for you to sit on, but all our goods are out in the garden houses, where we live in summer. We've sent a man to get you something to eat."

The villagers felt that they were wrong, for they knew that they had not acted according to the common practice of Mohammedans. Yet after all they did not care greatly, although they certainly objected to having a rival village praised at their expense, and to having the word go out at the neighboring bazaar town that their village was inhospitable.

Perhaps there was a tinge of malice in the remark which one man made to our Greek servant: "What big hats these men wear. They must be very great men, but the other foreigners who came here a few years ago were greater, because they had bigger hats."

Whatever their feelings, the people of Girmeh finally supplied our wants. They were evidently glad, however, when we went on our way westward through the beautiful pine woods on the mountain top, past the ancient and now waterless ruins of Cremna, and down into the barren land on the other side.

Girmeh lies about 40 miles from the Mediterranean Sea, north of the city of Adalia, which is located at the head of the great bay in the middle of the south coast of Asia Minor. To reach the village we had spent a hot morning in climbing nearly 3,000 feet westward up a steep slope of white limestone, from the valley of the Ak Su, which flows south through splendid forested hills to the plain of Adalia and ancient Pergamum, where Saint Paul began his famous journey in Asia Minor.

Much of the way the sun beat upon us from the bluest of skies, dimmed only by a summer haze which increased the feeling of languor occasioned by the warm, damp air. Often, however, we

A TURKISH MILL

A VILLAGE IN THE FORESTED BORDER OF ASIA MINOR

The rough shingles on the roofs are kept in place by rows of white stones

were in the shade of fine oriental pines, many of which have their branches bunched at the top in a form suggesting the palm. They were of a sunny yellow tint, washed, as it were, over deep green.

We were in a lovely land of sharp-cut cliffs of variously tinted limestone rising from rich green valleys, with pretty, prosperous villages here and there embowered in a wealth of trees. The ground, to be sure, was dry, and the abundant growth of spring grass had died entirely by the time of our visit in August, but trees and bushes were still verdant, and so, too, were the garden tracts watered by the great clear springs which determine the location of the villages.

Two days later we came to the village of Kuzzililar. It is only 50 miles southwest of Girmeh and 40 miles west of Adalia, but its scenery and the character of its people are absolutely different from those which have just been described. In spite of its nearness to the sea, the village gets little moisture, for it lies on the landward side of a range of mountains 10,000 feet high.

A gentle descent over treeless slopes brought us to an open plain, green with the reeds of a great swamp at the western end and brown with ripe wheat in other parts. The eastern horizon, toward the Gulf of Adalia, was black with the clouds and rain of a heavy summer thunder-storm, which cooled the plain but gave it no moisture. Westward the sky was clear except for a few light clouds, pink in the setting sun.

Here and there groups of harvesters with camels and donkeys were moving homeward toward the barren little villages of stone and mud nestled at the base of the mountains, where small springs furnish a scanty water supply. Elsewhere the villagers were still hard at work, eager to take advantage of every moment of daylight.

It was dusk when we reached Kuzzililar, a group of a dozen houses, with no verdure except a few willows and some fields of tall hemp surrounding every house. A harvester, just back from the field, pointed out the guest-room. It was so poor and forlorn that we did not wish to stay there.

"See," we said, "yonder is a good house, with two stories and an upper balcony made of wood. Let's go there and see if they won't take us in."

"Yes, it's a good place," answered the servants, "but don't you see there are 'black-eyes' there?"

Going nearer we hailed a young man, who evidently belonged to the house. He did not seem at all disposed to receive us, because, as he said, there was no room, and also the guest-house was empty. We were just turning away when a "black-eyes"—in other words a woman, so called because when she is properly veiled only her dark eyes are visible—looked over the railing of the porch and called out, "Let them come near, that I may see them."

She was the young man's mother and her word was law. On looking us over she decided that she wanted to see more of such odd-looking strangers, so up we went to the crowded porch, where most of the family appeared to be living. They moved inside, however, and left us in comfort.

When the head of the house, a keen old man, came from the fields, he began to reprove his son: "Why are the strangers here? Let them go to the guest-house, and not come here where the women are. There we will gladly bring them food and all things that we have. Why didn't you send them there?"

Just then his wife came up, and a single word from her turned him back to us with profuse apologies. "You are welcome indeed. I did not know who you were. I thought you were Circassians, come with tobacco to sell [an illegal and highly profitable traffic]. What village are you from? What do you bring to sell? Have the 'sharp flies' [mosquitoes] bothered you much? This wind will keep them away tonight. Is your village a large one? How many hours away is it? Make yourselves comfortable and soon my 'house' [that is, 'wife'] will have something ready to

eat. We are sorry that our fare is so poor. Come, let us look at your wares."

Great as was the poverty of this simple village and hard as the villagers worked, one felt that they were truly hospitable. Strangers were sent to them by Allah and were to receive the best that they had, and especially strangers who actually had nothing to sell and therefore must be great officials, perhaps on a secret mission. The old woman was simply delighted with a tin box and some sweet crackers that we gave her. The pleasure which she showed at the prospect of spending our present of a dollar in bargains for the children at the weekly bazaar proved how womanly she was, even though she did say her prayers like a man and rule the household with the hand of a tyrant.

The villages of Girmeh and Kuzzililar are typical of the two chief divisions of Asia Minor, both in scenery and in the character of the inhabitants. One division embraces the coastal region and the other the plateau. On all sides of the peninsula of Asia Minor, both on the Black Sea and the Mediterranean, mountains rise more or less abruptly to heights of from 4,000 to 10,000 feet. Their outer slope is comparatively well watered, because winds from the sea blow inward and are obliged to deposit their moisture by reason of the cooling which they suffer in the process of expansion due to rising. The case is exactly like that of Palestine and Lebanon, or like the mountains of California. Along the seaward slope there is a good amount of vegetation, and in many cases, where the mountains are of sufficient height, splendid forests form a belt from 5 to 30 or 40 miles wide. Beyond the crest of the mountains, where the inflowing air descends and therefore becomes warmer, the rainfall rapidly decreases and the country becomes dry and barren.

Hence the interior of Asia Minor, the great plateau some 3,000 feet above the sea, resembles the Syrian desert east of Mount Lebanon and the basin region of Nevada and Utah east of the Sierra Nevada in being much drier and less productive than the seaward slope of the country and in being practically devoid of forests.

During the visit of the Yale Expedition of 1909 to Asia Minor we saw an excellent example of the contrast between the coastal region and the interior immediately upon entering the country. We followed the famous route which leads from the northeastern corner of the Mediterranean Sea up through the narrow gorge of the Cilician Gates to the terminus of the Bagdad Railway at Eregli, on the southern side of the plateau of Anatolia.

Close to the sea lies the populous deltaic plain of Cilicia—warm, moist, and enervating—the product of hundreds of thousands of years of alluvial deposition by the rivers Sihun and Jihun. There are no more luxuriant grain fields, more fruitful vineyards, or richer gardens in all Turkey than those of Cilicia. The population is dense and comparatively prosperous, although not energetic. Factories of considerable size have recently been established, but it is interesting to note that it is not local initiative which keeps them up. The owners are largely men from Europe or Constantinople, and the employees are in good measure Armenians and others who come down from the poorer but more invigorating regions of the plateau to the north.

We visited Cilicia some ten weeks after the barbarous massacres of the spring of 1909, when 20,000 Christians, more or less, were slaughtered by fanatical Moslems at the behest of the former Sultan, Abdul Hamid II. In Tarsus and Adana, in the Armenian quarters, we saw street after street which had been reduced to a mere lane of ruined walls of mud and stone, seared by flame and blackened by smoke.

Within the open inclosures that once were houses a few miserable refugees were cowering under the open sky, enduring for a time in the hope that the reformed government of Turkey or the charitable Christian nations of Europe and America would aid them to build

AN ANCIENT INN IN THE TREELESS PORTION OF ASIA MINOR

A ROADSIDE FOUNTAIN

SWEEPING UP THE THRESHED WHEAT ON THE THRESHING FLOOR

A VILLAGE IN THE DRY PORTION OF ASIA MINOR

new dwellings and go on with their old life.

Some of the facts connected with the massacres illustrate the character of the Turkish people so forcibly that it is worth while to pause in our description of the country and record them. The facts belong to history, but they have a place in geography, because the character of any race is, in part at least, the product of the geographic environment under which that race has grown up, and of the movements of the race under the influence of geographic conditions.

In the more inaccessible parts of Turkey, especially among the high mountains which border the western plateau of Anatolia and which rise in all parts of the eastern or Armenian plateau, there are large numbers of people who are not Turks either in name or religion, and many others who are nominally Turks but are in reality the descendants of earlier races, such as the Phrygians, Lycaonians, Armenians, Karduchi, and Hittites. They have adopted Mohammedanism merely as a means of avoiding oppression and persecution.

The more open regions of the semiarid center of the country are inhabited largely by people who are almost purely Turkish in race. These, as might be expected, form the backbone of Turkish power and the flower of the Turkish army. The character of the true Turk has doubtless been greatly influenced by his present surroundings, and has certainly been modified by Mohammedanism, with all its inheritance of the habits and modes of thought of the desert. Nevertheless it still bears deeply the impress of the physical circumstances which gave rise to the nomadism of his ancestors in Central Asia.

To turn now to the specific facts which are here to be used as an illustration of Turkish character: On April 16, 1909, there occurred in the city of Adana a massacre of Christians by Mohammedans. One cause was the fact that in 1895-'96, when extensive massacres took place in other parts of Turkey, there was none in Cilicia, and the Turks of that region said, "Let us have a massacre also and get rich by robbing the Christians."

Other causes were the jealousy of many Turks at the superior ability and prosperity of the Armenians, a strong but false impression that the Armenians were engaged in revolutionary plots, and the anti-Christian feeling fostered by Sultan Abdul Hamid for the purpose of recovering the power which he lost when he granted constitutional government. Under such conditions it was an easy matter for corrupt officials to carry out the express orders of the Sultan for a massacre of Christians. At the time of the massacre troops were already on the way from Saloniki to dethrone the old Sultan and reinstate the new constitutional régime. Part of these troops were promptly deflected to Adana by the controlling committee of the Young Turks in order to put a stop to disorders there. The troops were chiefly poor, stupid peasants—young, ignorant, and inexperienced—but they were supposed to be full of the spirit of progress and liberty and fraternity, and to be devoted to the new régime. What, then, was the amazement of men of all opinions to hear that these troops reached Adana on the morning of Sunday, April 25, took over the guarding of the city from the old troops who had helped to carry on the preceding massacre, and on the same afternoon inaugurated a massacre of their own.

What happened appears to have been as follows, according to the statement of the most reliable authorities, including American missionaries, the English consul, some prominent Armenians, and some of the more liberal Turks:

When the Turks disembarked from the railway which had brought them 40 miles eastward across the plain from the port of Mersina, many local Turks of Adana, especially the Khojas and Mullahs, or religious leaders, mingled with them and said, "Thank God, you have come. Now at last we shall be safe. For days and days we have been living in terror of our lives. These terrible Armenians have been burning our

THE CITY OF ADANA (SEE PAGE 767)

ARMENIAN REFUGEES LIVING IN THE RUINS OF THEIR BURNT HOUSE AT TARSUS

TENTS OF SEMI-NOMADIC TURKS AMONG THE HIGH MOUNTAINS NEAR ADANA

A STREET SCENE IN THE DRY ANATOLIAN PLATEAU

houses, robbing our shops, and carrying off our wives and daughters. Now you have come and we shall be safe, but look out that they don't shoot you unawares."

So it went on all day, for a deep plot had been laid by the reactionaries. About four o'clock a soldier was actually shot, not by Armenians, but, as is generally agreed, by some Turk who thought it worth while to sacrifice a soldier for the sake of inflaming the rest.

The plot was successful. The soldiers became fully convinced of the perfidy of the Armenians, their stolid minds were inflamed, and nothing but a massacre would satisfy them. The soldiers believed that they were slaughtering their enemies and the enemies of their faith. They did not stop to think or reason; they simply accepted what was told them by those in authority, especially by the religious leaders.

The Turk is a slow man, mild and gentle and easy to deal with on ordinary occasions, but when he is aroused he loses all common sense and is a mere wild animal. This contrast between his ordinary mildness and his occasional ferocity is the explanation of much in his history. Possibly it has something to do with the fact that for long ages before his arrival in Asia Minor, six or eight centuries ago, his ancestors lived the life of nomads in the deserts of Central Asia. Such a life consists chiefly of long periods of passive inactivity, when the cattle and flocks are grazing peacefully and a man has no need to think, for there is nothing to do except watch the women work. Now and then, however, there come periods of the most intense and exhausting activity, when the animals are lost or are in peril from storms, wild animals, or raiders. Then the nomad becomes well nigh a monomaniac, and will endure almost unlimited privation and distress to accomplish his purpose.

To come back now to the two divisions of Asia Minor, the Cilician plain belongs, of course, to the well-watered coastal region. Going northward across it, one soon comes to the narrow valley which leads up to the Cilician Gates. Magnificent pine trees cover the mountain slopes, for rain falls even in the summer, when most parts of Asiatic Turkey are suffering from four or five months of absolute drought.

On our first night out from Tarsus we slept on the flat roof of the khan, or inn, but had to get up in the middle of the night and carry our beds under the shelter of a booth of leaves. Twenty miles seaward or 20 miles landward there was probably no rain, but we were in just the position where the air rising up the slope of the mountains was cooled sufficiently to give up its moisture.

In the khans the talk was still of the massacres at Adana, and especially of the punishment meted out to some of those who had taken part in them. The Turks did not seem to be much impressed by the fact that six Armenians had been hung for shooting some of the Mohammedan mob, in the attempt to defend their homes and families and their own lives. What did impress them was the nine Moslems who had swung for killing Christians.

To many it seemed to be an absolutely new idea that a Turk could be punished for any wrong done to an Armenian. "What," they said; "hang a Turk for killing a Christian! It *cannot* be. They surely would *never* do that."

And then one of them, wishing to clear his own skirts, told how some one had offered him a horse stolen from a Christian at the time of the massacre. He had refused to buy it, although the price was extremely low, because, forsooth, it had been stolen. The man may have been lying, but the fact that he should think it worth while to lie in regard to such a matter is significant. Formerly he would have boasted of plundering Christians; but now a new spirit is beginning to spread abroad, vaguely and unconsciously, to be sure, but with possibilities of growth.

The gorge leading up to the Cilician Gates is a fine bit of scenery, much better illustrated by pictures than described by words. The gate itself well deserves

THE CILICIAN GATES (SEE PAGE 770)

A TURKISH FLOUR-MILL

its name, for it is in truth a gateway, the only passage for a hundred miles or more by which it is possible to cross with ease over the Taurus range, whether one be going from east to west or north to south. Darius, Xenophon, Alexander, the Crusaders, and many other invaders have used it as a matter of course, because there was no other route. Many of them left the record of their passing carved upon the stone, but most of the inscriptions are now obliterated.

The gate is a narrow canyon, with almost perpendicular sides, at the base of which it has been possible to build a roadway only by encroaching upon the space where the river once ran. The narrowness of the gorge and the steepness of its sides are due to the fact that just here the limestone which composes the mountains has been sharply bent down to the northward and broken off. An unusually hard layer which normally lies on top of the other rocks is thus tipped over until it stands almost vertical. During the course of ages the softer rocks on either side have been worn away, and this layer has been left as a ridge running nearly northeast and southwest and cut in two by the sharp, stream-worn gash of the gates.

The Cilician Gates have been much talked of in connection with the projected Bagdad Railway from Constantinople to the Persian Gulf. For years the railway has waited at the edge of the interior plateau, unable, as it were, to get through the peripheral mountains and down to the Cilician plain. At last, however, it is about to move forward toward Adana and Aleppo, and ultimately, after 10 or 20 years, toward the Persian Gulf. During the summer of 1909 surveys were carried across the Taurus Mountains and construction will now proceed rapidly.

The line will not pass through the Cilician Gates, as has often been supposed. About five miles to the east there is another gorge, deeper and more inaccessible than that at the gates, but occupied by a larger stream, the Chakit. This branch of the Sihun heads well back in the plateau and runs direct to Adana, the objective point in the Cilician plain. The Chakit gorge is so narrow and deep that it has never been possible to use it as a roadway. For a railroad,

MODERN GREEK FOUNTAIN IN PHRYGIA WITH ANCIENT PERSIAN LION BUILT INTO THE CENTER: THE BOY IS A GREEK

however, it is better than the Cilician Gates, because it has been cut to greater depth across the ridge of hard limestone, and hence the grades are not so heavy.

Even so, the engineering difficulties are formidable. From the divide on the plateau near the head of the Chakit River the descent amounts to nearly 5,000 feet in 70 miles, as measured along the river, without reference to the minor windings. In the 20 miles of the most inaccessible part of the gorge the descent is over 2,000 feet, so that the average grade is more than one foot in 50, which is very difficult for heavy freight. Even if the railroad is built with many windings, the grades will be hard.

The expense is bound to be immense because of the large number of bridges, viaducts, deep cuttings, and tunnel which will be required. The German and Greek engineers who are laying out the route say that the line as a whole will prove as difficult to build as any in Europe, except the Simplon, in Switzerland, with its long tunnel.

A BIT OF THE TREELESS PLATEAU OF ANATOLIA

A PROVISION DEALER

Beyond the Cilician Gates to the northward forests continue for 10 or 20 miles, but they soon disappear, because the rainfall diminishes rapidly as soon as the crest of the Taurus Mountains is passed.

At length the road, a well-made macadam highway, leaves the Chakit Valley, which it enters beyond the gates, and rises over bare hills unrelieved by any trees except an occasional bit of oak or cedar scrub. Shepherds begin to be seen on every side with their flocks.

Little farm-houses are no longer scattered about here and there wherever there is a bit of land smooth enough for cultivation, but in their stead villages are seen clustered about the occasional springs, where alone it is possible to get water throughout the year.

The houses are no longer built with sloping roofs, thatched or shingled to keep off the rain and full of half-hewn logs of fine timber. They are made of mud and stones, with scarcely a trace of wood except for the beams on which the flat mud roof is laid above a layer of brush. What need of a sloping roof where the rainfall is so scanty, and, if one is needed, how can it be constructed where there is no wood and all men are poor?

In traveling back and forth between the coastal fringe of forests and the dry plateau of Asia Minor, nothing is more impressive than the contrast mentioned at the beginning of this article. Not only are the scenery, the architecture, the methods of farming, and the whole manner of life of the inhabitants of the two regions highly diverse, but the character of the people themselves differs greatly. This may be due partly to inheritance, but much of it arises from the nature of the land.

The dweller in the open dry country is relatively poor; he often suffers from want, due to bad crops; he travels much from place to place with his animals, and the outlook from his door is broad, and he sees the stranger approaching from a distance and is not alarmed by his sudden appearance. Hence he is ready to share his meager supplies with others, because he knows the need of help, and his nature is comparatively unsuspicious and hospitable.

With the inhabitant of the forests it is different. He lives in comparative comfort and rarely suffers from actual want. He dwells apart oftentimes and at most sees few strangers. When they come to him he is worried and suspicious. He is not ready to receive them, because in his own experience and in that of his forefathers there has been little need of asking hospitality from others.

In these ways and a thousand others the life and character of men reflect the peculiarities of their land. The soul of the people can only be understood by looking through the eyes of Nature.

NOTES ON NORMANDY

By Mrs. Geo. C. Bosson, Jr.

THE early history of Normandy, even taking it only from the reign of Richard the Fearless (997), explains in itself why today, to those who look below the surface, Normandy seems in many ways a separate land from France. The 30 years of English occupation under Henry V have left their lasting impress, though its natural position demands that it should be an integral part of France.

That Norman power of adaptation to circumstance was the "fatal gift," so apparent in its Sicilian conquest, which has destroyed the Norman as a separate race. It has been said that "the finished historian must be a traveler," but one who possesses to the full the instincts of the

CASTLE WHERE WILLIAM THE CONQUEROR WAS BORN

Located in the old Norman town of Falaise, this picturesque stronghold occupies a commanding position on a rugged promontory and is of great historic interest

traveler must know his history as he knows with his own eyes the true look of a wide land.

Picture follows picture in the radiant Normandy landscape; the limpid light is at once brilliant and tender, and the eye feasts always on a banquet of color. Between slits of cliff are bits of sea, poplars shiver in the sun, meadows slope from height to ocean, longing for the sea, and the green roadway threads its path through all. It is not strange that Isabey and Daubigny found beauty here. In fancy Richard Sans Peur and "le Hellequin" still ride through the forests, and legends people every ruin. Less in the present than in the past, one dwells much on the stirring times when Normandy had a life of its own and the Norman name was famous from Scotland to Sicily.

Honfleur is a quaint port, with its famous Saint Catherine's Belfry—house, shop, warehouse all in one, while a delicately modeled spire crowns the whole. Villas line the hills, old gates and watch-towers yet remain of the Honfleur of great days. Beyond the quay bristle a hundred masts, sails drip with color, and the water is Nile green—a bit of Cairo in the north of France. Along the water front the same old houses which nearly 300 years ago were brave in their brand-new carvings, as they looked out to see the high-decked Spanish ships ride in, dipping their flags to the *fleur-de-lis* of France. Then Havre was only a strip of yellow *plage*, before the threatening sand bar stole Honfleur's harbor inch by inch.

Lisieux is one of the charming corners where something still remains of the Middle Ages, and in the church are windows depicting the marriage of Henry II and Queen Eleanor, and Thomas à Becket in his Norman exile.

The most personal beginning of the Norman conquest was at Falaise. There from a window of the lofty castle-keep Robert, Count of Hiesnes (later Robert the Magnificent and Robert *le Diable*), saw Arlette, the tanner's pretty daughter, washing clothes at the riverside. With all the settings of romantic legend she became the mother of that king whose bar sinister was blotted out in Conqueror.

At Caen we are in his footsteps. Saint Etienne contains his tomb, and has an interior remarkable for strength and solidity—a perfect example of the Norman-Romanesque, adorned (?) though it now is by 24 glass chandeliers of the 19th century's most lurid pattern. The Hotel de la Monnaie is a splendid house, built by a princely merchant, Etienne du Val, Sieur de Mondrainville, the man whose great wealth enabled him to get sufficient supplies into Metz for it to withstand its siege in 1553.

There is an atmosphere of heroes and kings in Caen. We see the tomb of the Conqueror and the house where Beau Brummel died. We see the ruined castle where *"le jeune et beau Dunois"* performed prodigies of valor, but on church walls are pasted the staring notices of *"loteries nationales de France!"*

Many French artists, archeologists, and men of letters are alarmed at the lack of consideration manifested by the state for the national monuments, which are being allowed either to fall into decay or to be restored with indiscretion. The great master Rodin is deeply concerned with this question, and in his desire to awaken public interest is about to bring out a series of essays (in his modesty he calls them "notes") on The Cathedrals of France, the study of which is his favorite pastime.

The walls that William built and Froissart writes about are a girdle that is lost today. The Conqueror's vow is brought to mind as one looks at l'Abbaye aux Hommes, and *vis-à-vis* l'Abbaye aux Dames, like the queen who builded it, sits on a throne.

It is at Bayeux, though, that one feels nearer that queen, Mathilde. Gray, dim Bayeux, old even then, when the Conqueror's queen was writing history with her needle. The first of the great French realists, she seems to me, in the naïve sincerity of those old tapestries, which truly are an epic.

HOTEL DE LA MONNAIE: CAEN

A distinctive example of the beautiful architecture of the Renaissance built in the sixteenth century. The ancient city of Caen on the River Orne was the favorite dwelling place of William the Conqueror and his last home. Caen, it is said, was founded by the Saxon Otlings between the third and seventh centuries.

BRETON COSTUMES WHICH ARE FAST BECOMING OBSOLETE

MONT SAINT MICHEL

This stark granite rock, upon which a fortress, an abbey, and a church were builded during five centuries beginning with the seventh, is justly called the Pyramid of France. Situated in the Bay Saint Michel within sight of the sea, it is seemingly the prey of the wonderful tides that sweep in faster than a horse gallops

THE PORTE DU JERZUAL: DINAN

A gateway of great architectural interest, since it is Gothic without and Romanesque within. The old city of Dinan is what its name signifies, "The Fortress on the Water," being situated on the summit of a great hill of granite overlooking the River Rance. It dates from the Roman period and contains many architectural treasures.

Just a paragraph to percherons, between towns. For who can think of Normandy without them, the darlings! Along the smooth white roads they pass in sturdy line, with that majestic dignity only possible to thoroughbreds, whether horses or humans. Their mottled haunches and polished coats gleam like mother-o'-pearl, and their liquid eyes speak volumes to one who loves them.

Then Dives—Dives, with its inn of the conquering William, where Madame de Sévigné really left her patch-box, and one almost fancies the odor of rose leaves behind her—where the cook beats eggs in old Caen bowls that the china collector greedily gazes on, and where the exquisite tapestries ought to be put under glass. A château it was, built for the Conqueror while his boats were building that he crossed to England in, and over the door are still the arms of an old seigneur who married into the house of Savoy. Dives' port, now nearly choked with sand, was once a great haven. There William's fleet, assembled for the conquest of England, lay a whole month awaiting the favorable winds which never came until they had changed their position to Saint Valery.

Between Rouen and Havre is the pretty town of Caudebec, with quaint timbered houses and its broad terrace beside the river. On a market day, in the Grande Place in front of the church, is to be seen one of the few old-time sights of Normandy, the grand old church and the place itself contributing their share in the *ensemble*. But the traveler who would see this specimen of an old Norman town, wearing still its mellow and picturesque charm, must hasten thither without delay.

Mont Saint Michel, with its detached air, appears as though man and nature united in their work to build a masterpiece. Its one straggling street, that begins in the gateway of a king and ends—ah, that is the point. Where does it end? Three times did the vision of Saint Michel appear to Saint Aubert, commanding a church on the rocky heights. Hence rose that marvel of early Norman architecture, with its tombs of saints and heroes and brothers of kings, its Black Virgin, its Salle des Chevaliers with sunlit aisles, its cloisters and exquisite colonnades. As one thinks of the history that has peopled this pinnacled hill, emotions, impressions, and sensations crowd the mind, and surely the faintest imagination can fill the structure with the kingly shapes and knightly shadows of the Hundred Years' War.

Trouville, Deauville, Dieppe—in a short sketch of Normandy I purposely omit those gay bathing places, those "*doubles extraits de Paris.*" They are Watteau in the 20th century, though, and the salon of a casino in the height of the season is an animated and diverting scene.

In Normandy the artist may find congenial occupation and the opportunity, so difficult in these days, of sketching picturesque types—groups at the market place, groups at the inn doors, horses in clumsy harness, goats and sheep in biblical mélange. He will find doors and porches of so good a pattern and so old that they are new to the world of today. One may learn the value of variety in its simplest forms and realize the artistic worth of high-pitched roofs and contrasts in color, if it be only of dark beams against plaster, and of meaning in the lines of construction. But these treasures of Normandy are disappearing fast and must be quickly gathered.

In all the fair Normandy coast, each year more and more is there a disappointing note. One looks almost in vain for the old Normandy costumes; the blouse and the close white cap are all that are left now of the wondrous headgear, the short petticoats, the embroidered stomacher, the Caen and Rouen jewels of a generation ago. Modernizing destruction is rapidly blotting out the memory of old days!

OUR GREATEST PLANT FOOD

By Guy Elliott Mitchell

IN estimating the possible limit of American civilization, strength, and supremacy, has any economist ever recognized as a factor the phosphorus supply? Why, how absurd! Phosphorus? What has it to do with civilization? Its principal uses are for matchheads and as a fertilizer for plants. Ah, a fertilizer?

"Westward the course of empire takes its way—and leaves the ruined lands behind."

This is not a pleasing paraphrase, but it is true, and largely because those lands, after years of cropping, become deficient in phosphorus. Therefore it may be admitted that the government's present activity in applying conservation methods to the public phosphate lands, just as it does in the cases of coal and petroleum lands, is wise. But is it really necessary to carry out such drastic measures as are proposed for the phosphate lands and prevent the exportation of phosphate from government deposits, and thus unquestionably curtail the development of what is rapidly growing into a great American industry? Let us see.

The problem of farm production is the most important question which the American nation has to consider. It transcends all others, economic or political. If the broad farming lands of the Republic maintain or increase their fertility and productivity, all other problems will eventually right themselves more or less satisfactorily and the prosperity of the country be absolutely assured.

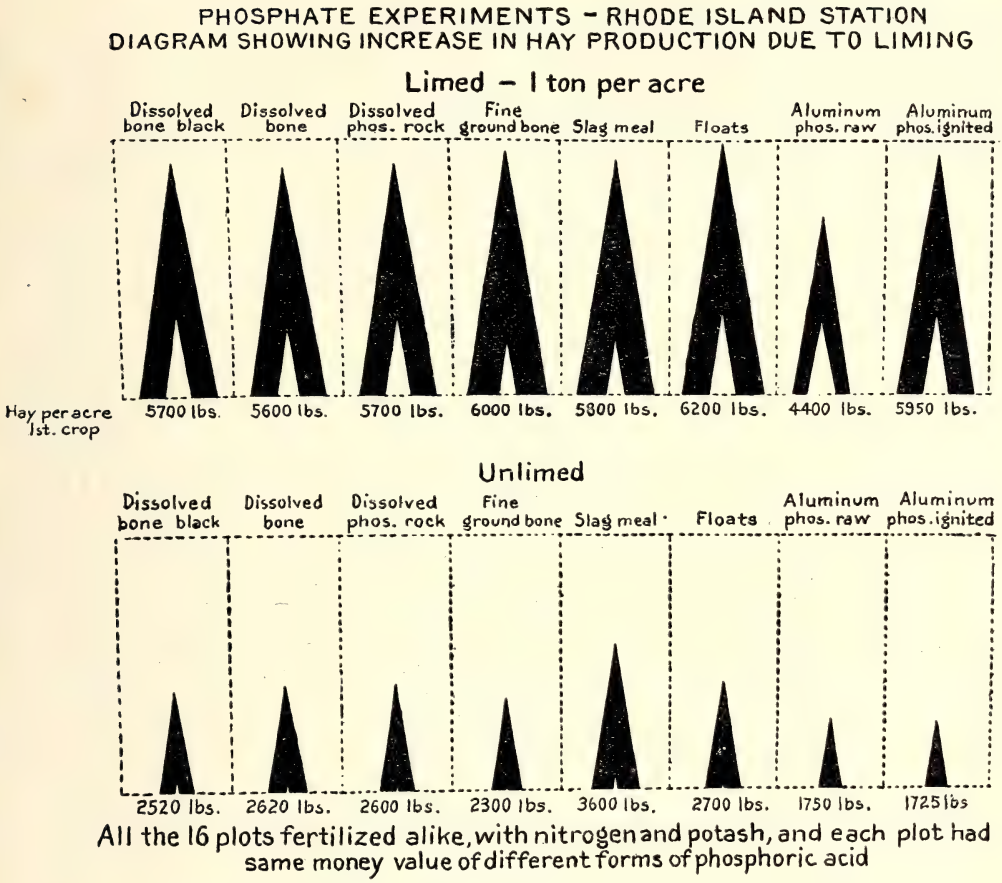
Phosphorus is one of three absolute essentials to plant growth. If you take a flower-pot of clean, sharp sand, containing no fertility, and add nitrogen, potash, and phosphorus, plants will grow and thrive. If you leave out any one of these three, the plants cannot grow. Now the natural supply of phosphorus is surprisingly, alarmingly small.

In the early alchemy of the earth, commencing when time was very young, and when the Archean rocks were just beginning to push their way upward through the universal Silurian sea, and then passing on down the inconceivable geologic ages to the advent of man—which was but yesterday—Mother Nature industriously and, in most instances, lavishly provided for all the necessities of the human family which was to appear. In most cases it is seen that she allowed a generous margin—enough to provide for use and abuse of the unreplaceable resources. On all sides the earth is found to be a vast storehouse of crude materials which, through the aid of human genius, are convertible into the necessities and luxuries of existence. But in stocking the earth with one necessary element Nature certainly overlooked entirely the attributes with which she was to later endow the human family, namely, his tendency in the midst of present plenty to disregard the future. This element is phosphorus.

"Now what new crazy scare is this?" exclaims the thoughtless optimist, the man who blindly preaches that human ingenuity will solve every problem as it is presented. "We are so tired of this talk of waste! waste! waste! Of being told that our forests are all disappearing; that our grandchildren will have no coal; that our iron supplies will not outlast the century. The earth and the air constitute a huge reserve of elements. When wood becomes scarce for building, if it ever does, its place will be largely filled by stone and other earth products; when the coal supply gets low, in 100 or 500 years, according to the various guessers, we will use electricity for power and the sun for heat; when the iron deposits become depleted, many centuries hence, we will perhaps have to stop building ridiculous sky-scrapers, and will then erect

WHEAT YIELD INCREASED 133 PER CENT BY PHOSPHATE

Wheat-growing experiments at Urbana (Illinois) Agricultural Station, on land where cow peas had been plowed under. Land shown in upper picture was given an application of lime, and yielded only 9.2 bushels of wheat per acre. In lower picture lime and phosphorus were used together, and yield was increased to 21.5 bushels per acre.



HAY CROPS MORE THAN DOUBLED BY USE OF PHOSPHATE

This diagram affords an interesting study. In reality a liming experiment, it shows phosphorus to be a controlling factor in production of the highest importance. It will be noted that "floats," or raw phosphate, gave the largest yield.

substantial buildings of masonry; when the oil and the natural gas wells run dry, electricity will be gathered from the clouds. We are but in the infancy, on the threshold of discovery and invention. Phosphorus! Brimstone! Let the parlor match become a lost art; man will strike a light from the sun!"

So he will, doubtless; but when the housewife ignites her sun-cooker she must still have bread to bake, meat to roast, and vegetables to boil in plenty, else our people will be illy nourished and our world-pace will slacken and cease. And this is the problem into which the phosphorus supply enters—food.

There are three necessary elements to the production of plant and therefore human food, and only three; but all the discovery and invention and genius in the world, added to all the knowledge that may be obtained from the Martians and other beings, cannot supply substitutes. They are nitrogen, potash, and phosphorus. And, in supplying the earth with just enough of the last-named, and no more, Nature forgot that she was going to instill into man the spirit of wastefulness; and so she has, by limiting her supply of phosphorus, in reality fixed the limit of human existence. Man can lessen or extend that limit as he wastes

or conserves his meager store of this most precious element.

Now how much phosphorus is there? The lithosphere, or outer crust of the globe, holds enormous available supplies of nitrogen, and contains nearly three per cent of potash, well distributed and available as plant food. These supplies are inexhaustible.

But it contains only about one-tenth of one per cent of phosphorus. This is phosphorus enough to grow perfect crops, but there is practically no margin for waste.

Yet the waste is large and constant from every American farm acre, and, under the present practice, the end is in sight for American agriculture—not a thousand years hence, but almost now. In fact it has come to some farm sections. Science realizes it and is preaching the danger, but the people, the producers, cannot see it. Dr. Hopkins, of the Illinois Experiment Station, demonstrates the fact on the so-called inexhaustible black prairie bottom lands of fertile Illinois. What then of the long-cropped lands of New England and the more southern Atlantic Coast States? Let us see what the cold, uncontrovertible facts show with relation to the degeneration of the rich and comparatively new farming lands of Illinois, then apply the information to the rest of our farm area, and see how long under present practice we will be able to maintain our agricultural supremacy, and therefore our prosperity as a people. And then, while there is yet time, let us supply the only remedy.

The average of the different kinds of Illinois soils contains 1,191 pounds of phosphorus per acre for the surface 7 inches of dirt. But a 75-bushel crop of corn, for instance, will remove from an acre of soil 17 pounds of phosphorus, and, at this rate of cropping, the total phosphorus content of that soil would be exhausted in 70 years. If the grain is fed on the farm a good proportion of this plant will be returned to the soil. To prove that in actual farm practice the rate of exhaustion is startlingly rapid, a series of soil analyses in three States is cited by Dr. Hopkins, and they show that ordinary cropping for 54 years took away 36 per cent of the original phosphorus content of these soils.

Now, to replenish soils depleted of this necessary element through cropping, we must draw principally upon the natural supplies of concentrated phosphorus. The greatest source of phosphorus is phosphate rock, the petrified remains of myriads of antediluvian animals, and the principal deposits of phosphate rock are found in the United States. Again, the greatest of these have been but recently discovered in the public-land States of Wyoming, Utah, and Idaho. This field embraces the largest area of known phosphate beds in the world. The United States produces more phosphate than all other countries together. To merely offset the rate of loss above mentioned and maintain the present fertility of all the cropped land in the United States would require the use of over 12,000,000 tons of phosphate rock annually.

But people say that there are inexhaustible supplies of this phosphate in the great deposits of Florida and other States. There are, it is true, large deposits of this precious mineral, but the supply is far from inexhaustible; it is distinctly limited and all too small. Moreover, heavy inroads have been made into it, and the worst of the situation is that one-half of the phosphate mined in America is being exported to enrich the worn-out and competitive lands of foreign countries.

"American phosphate for the American farmer" is a good cry; it might well be adopted, not as the warning of the sentimentalist, but as a grim slogan of self-protection.

The Geological Survey's last estimate, admittedly conservative, for the total tonnage of the high-grade phosphate deposits of the United States, was less than 150,000,000 tons—a 12-years' supply to offset our present waste. Since then geologic work has developed large deposits, notably in the public-land States of Wyoming, Utah, and Idaho; so that it

TURNIPS AND CLOVER RESPOND HEAVILY TO PHOSPHATE STIMULATION

Experiments of Maine Agricultural Station with phosphorus in which raw rock phosphate applications shows the heaviest yields.

Turnips: Box 1, dissolved phosphate; box 2, raw phosphate; box 3, insoluble phosphate of iron; box 4, no phosphate.

Clover: Box 1, dissolved phosphate; box 2, raw phosphate; box 3, insoluble phosphate of iron; box 4, no phosphate.

may be reasonable to make a guess of the existence of double this figure, or 300,000,000 tons. But every ton of this will be needed on American farms, and it should be our hope that other great deposits may be discovered which will yet again double this tonnage.

And exportation of this vital element should be stopped.

The following tables, compiled from the figures of the Geological Survey and the Bureau of Statistics, show the production and exportation of high-grade phosphate rock:

Production and Exportation of Phosphate Rock in United States

(From the beginning of the industry to 1900, the production was 14,993,396 long tons; export figures covering this period are incomplete.)

Year.	Production, long tons.	Exportation, long tons.
1900	1,491,216	776,220
1901	1,483,723	624,996
1902	1,490,314	747,672
1903	1,581,576	817,503
1904	1,874,428	849,130
1905	1,947,190	879,979
1906	2,080,957	964,241
1907	2,265,343	900,983
1908	2,386,138	1,188,411
1909 (estimated)	2,500,000	1,300,000
Totals	19,100,885	9,049,135

We have thus mined 34,000,000 tons of phosphate, while during the past ten years our exports have been one-half the production. But how can exportation be curtailed? Obviously you cannot successfully appeal to a New Jersey corporation backed by foreign capital and organized for the purpose of mining and exporting Florida and Tennessee phosphates, and which owns the phosphate deposits.

Yet something can be done, and the prospect is one to arouse the enthusiasm of every American. Through great good fortune the nation still owns by far the largest portion of the phosphate lands, and it may yet go down in history as the greatest act of President Roosevelt's administration that he withdrew from entry all known public phosphate lands with a view to asking legislation which would allow their mining only on condition that not a pound of the phosphate should be shipped beyond the borders of the United States.

In December, 1909, on the recommendation of the Geological Survey, 4,541,300 acres of public land in Wyoming, Idaho, and Utah, known to be in part at least underlain with phosphate beds, were withdrawn from entry. Upon further investigation 2,570,017 acres of this were found to be non-phosphate, and were promptly restored, while 400,000 additional acres of phosphate lands have since been withdrawn in this western field, besides 2,400 acres in Florida.

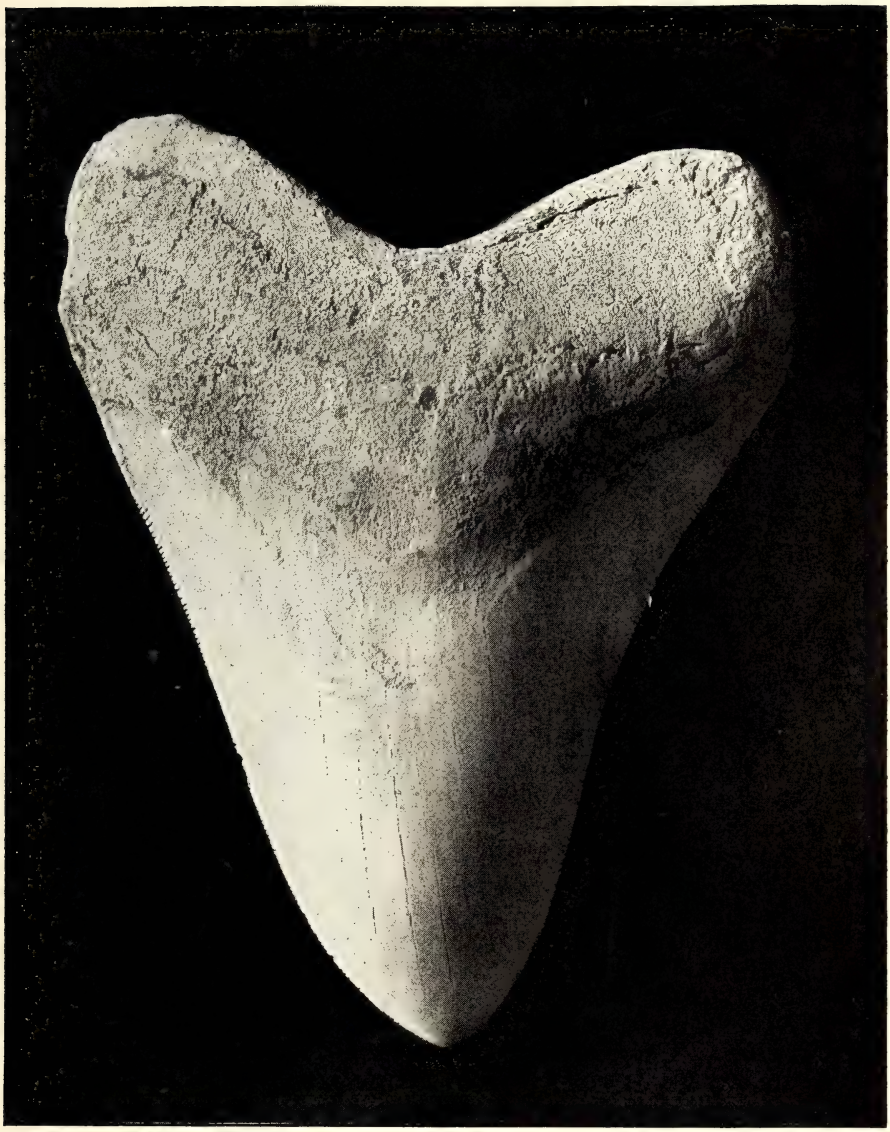
The public lands at present withdrawn on account of their valuable phosphate deposits are as follows:

	Acres
Florida	2,400
Idaho	1,149,569
Utah	87,040
Wyoming	1,267,494

This season three Geological Survey parties are in the field studying the deposits and procuring data for further classification.

It may not be generally known that Florida yet contains a large amount of government land. The phosphate deposits of the State have been little studied geologically, but there are believed to be many large unknown beds. At any rate, 2,400 acres of government phosphate lands in the State were withdrawn in May, 1910, and other areas are to be withdrawn. This checks the export game from the major portion of the phosphate fields, although the international fertilizer trust and other companies are understood to be in the market for any good phosphate land.

Following the first withdrawal of the phosphate lands in the West, the director of the Geological Survey was called upon to explain to the Public Lands Committee of the House of Representatives why he recommended this withdrawal. A number of lawyers who were present at the hearing representing western interests criticized and protested against such government interference with the development of the West, and were emphatic in their statements that the phosphate deposits of the world were practically inexhaustible. They cited accounts of phosphate discoveries in the South Sea islands and other sections of the world, and characterized the phosphate conservation movement as an absurdity. Director Smith replied to the effect that there had been some questions raised as to the legality or constitutionality of attempting to limit exportation of phosphate rock. He stated that he would hesitate to express an opinion upon such a matter as being outside of the scope of his activities; but when it came, he said, to lawyers invading the field of geology and present-



PURE "PHOSPHATE ROCK"

A prehistoric shark's tooth, natural size, found in Florida phosphate mine. Millions of such teeth, large and small, are shoveled out by the big mining dredges

ing off-hand statements as to unlimited supplies of a mineral and inexhaustibility of deposits, he felt called upon as a geologist to challenge such statements. By training the geologist was better fitted to see deeper into the ground than a lawyer could, and to estimate farther ahead in the matter of mineral deposits or supplies.

In this discussion the western attorneys denied that there was any intention of securing these lands for the purpose of exporting phosphate. It appears, however, at the very time that Director Smith

was making his statement the Geological Survey received a communication from the German consul at Atlanta, Georgia, stating that he had seen the notice of withdrawal of public phosphate lands, and that, as it was of the greatest interest to the German importers of phosphate rock to know to what extent they might depend on the output and exportation of phosphate rock in the United States, he requested such publications as might pertain to the subject. "It would especially interest me to know," he wrote, "the exact extent of the areas containing phosphate rock, and to be informed which of such lands are owned by the United States and by different individuals, States, and private companies." It will appear from this that the foreign fertilizer interests did in fact have their eyes turned toward these western fields for exploitation following the exhaustion of the eastern deposits.

As little is known by the great majority of farmers on the subject of fertilizer as perhaps any vital problem which confronts them, and many a man applies expensive nitrogen and potash to land which needs only phosphorus.

The Ohio Agricultural Experiment Station, in a long series of experiments with crops of corn, oats, wheat, clover, and timothy, has shown that every dollar invested in phosphorus paid back $4.76 under conditions in which neither nitrogen nor potash paid back their cost. The same station has found as the average of 56 tests in 11 years' work that when rock phosphate was applied in connection with manure every dollar invested in phosphate paid back $5.68.

Other interesting experiments have shown that raw phosphate rock, ground very fine and applied directly to the land without chemical treatment, is in most cases far more beneficial than what is known as acid-phosphate or phosphate rock dissolved with sulphuric acid. Until recently it had been assumed that, unless so dissolved and made "available" for the plant's use, phosphate rock was of no value as a fertilizer. It is now known that for use on all but very thin or impoverished lands raw phosphate will produce equal if not greater crops than the dissolved phosphate, while the sulphuric acid treatment approximately doubles the cost per ton of the phosphate and the fertilizing value is only about one-half. As a permanent improver of soils the untreated rock has much greater efficiency.

In dozens of State and Federal experiments the great increase in crop yield on almost all soils through the use of phosphate has been clearly proven.

Our first phosphate mining began in South Carolina in 1868. That State has since mined 12,000,000 tons, but her supply is largely exhausted. Florida came forward in 1888 as a great phosphate field, and she has produced 15,850,000 tons and is now the greatest producing State. In 1908 her output was 1,692,102 tons, valued at $8,500,000.

Tennessee phosphates were discovered in 1892, and this field became the greatest then known. About 5,800,000 tons have thus far been produced and the development of the field is yet in its infancy. However, considered as the sole source of supply, at the present rate of increase in national production the Tennessee phosphates would last only 11 years.

Arkansas next entered the field as a phosphate producer, but the rock is low grade and the output is small. Then came the discovery, a few years ago, of the great phosphate field of Wyoming, Utah, and Idaho, and it is in this and in the public phosphate lands of Florida that lies the hope of the American farm. On the basis of a rough reconnaissance three years since the United States Geological Survey estimated the tonnage of this western field at 63,000,000 tons, but further field work has shown this to be much too low. It is to be hoped, and it is the belief of the writer, that the detailed geologic investigation of this large field now in progress will show this figure several times multiplied.

Pending the proposed legislation by Congress, the known government phosphate lands remain safely tied up by the executive branch of the government,

while additional areas may be expected to be withdrawn as fast as they are found to contain phosphate. The proposed legislation is comprehensive, and, if Congress has in mind the future cost of living, the export restriction will include all public phosphate land in the United States now known or later discovered.

The geologic age during which the western phosphates were laid down was one of immeasurable importance to man, who, millions of years afterwards, was to appear upon the earth—the Carboniferous Age—that of coal and other useful minerals. This period followed the one when the Rocky Mountain backbone of the continent was beginning to push its way upward, and when a large portion of North America was covered by the shallow, primal ocean. The western phosphate beds were deposited by the washing down of the remains of myriads of minute animals on to what was then a shallow ocean bottom. The climate of the region was almost tropical, producing gigantic ferns, palms, and huge trees, but the animal life which contributed to the priceless phosphate deposits constituted a very low order. The giant reptilia, the great dinosaurs and plesiosaurs and other huge creatures came later.

The statement has been made by more than one person that this whole fertility-of-soils question is a false alarm. Why should our lands become so soon deficient in phosphorus when the soils of older countries have been farmed for centuries without extensive phosphate applications? The answer is that, in addition to shipping abroad great quantities of raw farm products containing thousands of tons of phosphorus, we waste. The Old World has learned to save and utilize sewage and various by-products which we destroy. American farmers have burned up millions of tons of straw and cornstalks containing large amounts of plant food. Dr. Van Hise, of Wisconsin, estimates an annual waste through the sewage of only the larger cities of the United States of the equivalent of 1,200,000 tons of phosphate rock. The total of the waste of phosphorus, potash, and nitrogen through exposure (see page 788) and other loss in the careless and ignorant handling of farm manure has been stated at between $50,000,000 and $100,000,000 annually. Until America learns, therefore, to avoid waste to a much greater extent than at present, there will be need for the application to the soil of much nitrogen, potash, and phosphorus.

And the greatest of these is phosphorus.

CURIOUS AND CHARACTERISTIC CUSTOMS OF CHINA

By Kenneth F. Junor, M. D.

NOTHING so profoundly impresses the traveler in China as her complete reversal of the greater number of our manners and customs. This fact is everywhere and every day evident.

The world generally believes the Chinese to have been always a stagnant nation, which is a great mistake. Changes in the fundamental form and character of the government have swept over China at frequent intervals with an intensity amounting almost to revolution.

Down through all the ages, from 1500 B. C. till today, certain forces run through her history like golden cords binding this great people into almost eternal solidarity. Among these are:

1. Belief in an omnipotent force—not always a person.

2. The deep sense of retribution, inevitable for all men.

3. Reverence, often changing its object, but ever there.

4. The sense of filial obligation, never diminishing, and extending even to the unseen personalities.

These are great forces in life—individual and national—and in no land are they so powerful or so all-pervading as in China. No people are more potently influenced by the unseen world.

Chinese civilization is one of the oldest on earth, and the only one which has continued uninterruptedly and vigorous till the present day. That it is vigorous is strongly impressed upon the man who travels far in that land. The reach of imperial authority is a constant subject of surprise and wonder. The card of an imperial prince, given to a traveler, will convey him safely and unmolested and secure for him courteous treatment to the remotest borders of the land: and yet China, unlike Japan, has never been under the domination of an aristocracy. The strength of certain governmental forces, under apparently disjointed conditions, is to the bewildered traveler as pleasing as it is surprising.

He finds relays of guards ready to receive him from the hands of one official and to convey him to the safe conduct of the next, and that frequently among peoples who have no knowledge of each other's speech and through officials utterly unknown to each other.

All officials, the binding links of this great government, come first from all the provinces, through their ancient system of civil service examinations, held in every great city. Finally they reach Peking, the capital, to be there fully equipped for government service and then sent back to represent and exercise imperial authority over the whole empire.

This civilization is unique and exceedingly difficult to understand. It is in some particulars so fixed and apparently impracticable, and in others so flexible and even loose, that it seems a mass of contradictions.

THE FORM OF GOVERNMENT

The form of the government is an imperial democracy. The imperial authority is absolute, but only within the law. The right of the people to revolt and dethrone the sovereign is most tenaciously maintained, notwithstanding the fact of the sacredness of his person in his being the ecclesiastical as well as the civil head of the nation.

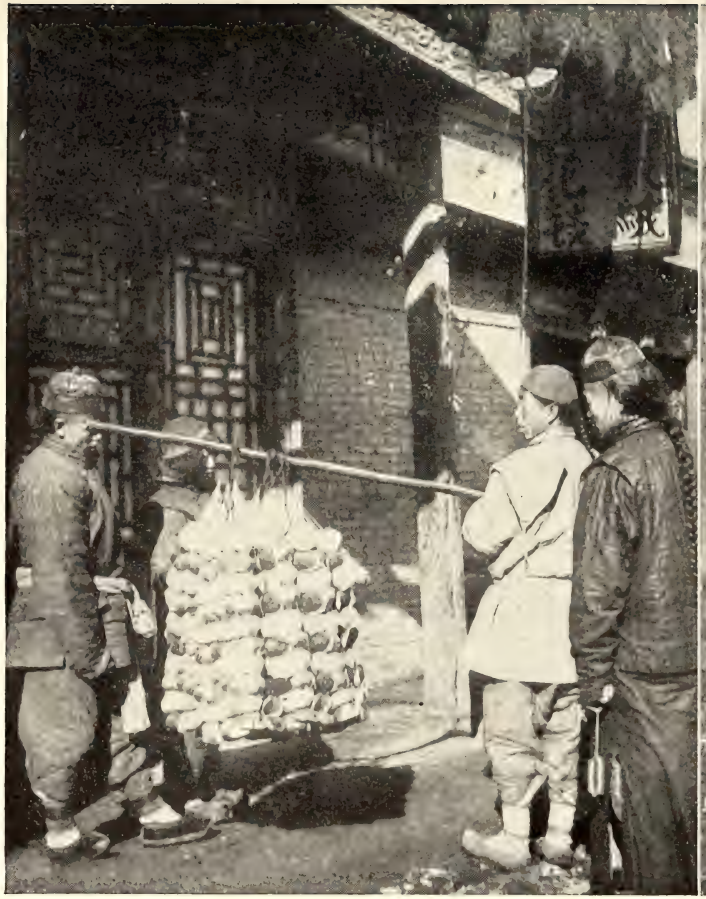
The imperial censors, a department of the government, have been known to call down the Emperor, when acting illegally, as inflexibly as they would the humblest official. A censor, in fact, has been known to do this, and then take his own life at his sovereign's feet.

"The divine right of kings" has never had a place in China's polity as it was understood in Europe. Democracy is most plainly manifest in her municipal organization and administration.

This is the land whose cities have no lights, no plan, no sewers, and no sidewalks. Her people have no public spirit, no patriotism, no idlers, no national feeling, and no secrets. The splendid monuments of one dynasty are almost invariably destroyed by its successor. A deeply religious people, yet, according to their proverbs, priests and temples are a curse.

Notwithstanding all these anomalies, every province, every city, every hamlet is districted, and in the hamlets some respected citizen is recognized as head man. He is held responsible for its good conduct. If any crime is committed he is held till the culprit is found. In a land where there are few secrets, and where these head men are very close to the people, the guilty seldom escape. Numberless cases of social trouble and dispute are, through this arrangement, never brought to the courts, but are settled among themselves. This paper, of course, records the conditions only among those Chinese who have come little in contact with foreigners and who constitute the vast majority of the nation; whose heroes are pictured sitting on their halos instead of wearing them.

Her millions amply testify to ages of untiring energy in her stupendous public works, her myriad walled cities, her great wall, 1,500 miles in length and from 20 to 25 feet both in thickness and height, climbing the mountains and span-



Bargaining for gold and silver shoes (ingots) made of paper for use in temple worship and at funerals: Peking, North China

Photos from Rev. B. St. John

RAG-PICKERS IN PEKING, NORTH CHINA

ning the rivers, being in many important passes double-built 2,000 years ago. What nation can match it?

Her canals surpass those of any nation in history in their extent, and here is found the longest canal in the world. It was built at the dawn of the Christian era, and is 800 miles in length.

Think of her hundreds of cities which are circled by mighty walls, some of them from 40 to 50 feet in both height and thickness, and the human labor expended in their erection.

Ethics, conduct, personal and official, the principles of government and religion have all been discussed, ably and even exhaustively, by the scholars of China in public and in books; first by Confucius and Mentius, 600 years before the time of Christ, and since through succeeding ages by many thousands of less celebrated but able writers.

THE LITERATURE OF CHINA

One of the most remarkable literary sights in the world can be seen at Hsi-Si, the seat of an ancient university, where are 320 massive stone columns on which, through the ages, have been inscribed the names of more than 60,000 of China's highest graduates. The writings of this literary host constitute a splendid body of literature of millions of printed volumes, for China had books ages before the West knew printing.

The time of Confucius and Mentius was China's golden age. The influence of their writings surpasses anything in any language. Every Chinese student, every official for 2,500 years, has studied them as classics. They have memorized the sayings, thought the thoughts, and, more or less closely, followed the example of these great sages.

Think for a moment of a great people through 25 centuries forever harking back to these remote ages and these truly great men. Who can measure the influence, even of this attitude itself, under such conditions, and who the influence of writings whose power has been acknowledged by millions through 2,000 years? No wonder it has made them a peculiar people, intensely conservative and exhibiting a civilization which is a complete reversal of our own, which is the development of an opposite experience and purpose, namely, looking toward the future.

Many a Chinese emperor has sought to break the power and force of this literature, feeling it to be a millstone about the neck of despotism. One of the greatest of the emperors, the one under whom in 230 B. C. the Great Wall was built, ordered all the great writings to be consumed to ashes, and this was done. But the great scholars who had them stored in their memories rewrote them, and, to secure them against any second destruction, in 170 B. C., had them engraved upon 170 slabs of granite, which remain to this day. From these tablets, by a happy accident, the art of printing was discovered. A damp paper having been one day laid upon their face, the impression was noted and the discovery made about 650 A. D.

The scholars today rule China. Where dress is of more moment than in any country, yet the scholar, though poor and meanly dressed, is received with honor by the highest in the land.

"The superior man" of the classics is the equivalent of the *"good man"* with us. This man, his character and his conduct, is their constant theme. His virtue, his honor, his social relations, his manners in public and private are carefully defined. His dignity is among his highest qualities and must be maintained at any cost. Ceremony, with a capital "C," is his life. So deeply has ceremony burrowed into his character that it not only reaches the absurd but approaches the tragic, since it must be maintained, even at the expense of truth.

The very character in which the classics are written is worshiped. Literary societies all over the empire send out men who collect every piece of paper, every bit of wood or crockery on which is written or printed a character. These are all consumed to ashes in bronze urns at the Confucian Temple, and are then carefully boxed and carried in procession,

WOMEN WOOD-CARRIERS

THRESHING BEANS

followed by all the officials in their official robes, and cast into the water as an offering to the god of literature.

THE DIGNITY OF CORRESPONDENCE

While we construct our sentences to make our meaning clear, the Chinese love to conceal the meaning, only giving you a clue by which you may discover it. In epistolary correspondence they are absurdly ornate and stilted. For example, a Chinaman, on receiving word of the death of his parent or relative, will call upon some one, perhaps a young lad, to procure a stereotyped letter from a copybook, one suited to the social standing of the deceased, tell him to copy it, and send it off for him. It must be in good form in any case. Official documents, on the contrary, are terse and to the point.

The reason for this strange reversal is this: Correspondence is common and is therefore likely to become careless and vulgar in style. Official documents are not exposed to this danger; therefore the dignity of the endangered style must be sustained. The claims of affection give way before it. The character of an official document will sustain its own dignity.

The "superior man" never calls a spade a spade, as with us. A "sheet of paper" is a "flowery scroll" because of its possibilities. "Husband and wife" are "tenor and treble" because of their verbal relations. "A genius doing drudgery" is a "race-horse to a salt wagon." The prettiest street in Canton is called "Street of Refreshing Breezes," etc.

The boy in school turns his back upon his teacher when reciting, to show his humility and respect in the presence of the scholar. There is also the practical reason that he is thus unable to gain any help from the teacher's expression of face.

The Chinese read from above downward and from right to left. Books are printed on only one side of the page, and the page is a double sheet. The language has no grammar. A school is a bedlam of noise, because each child recites constantly at the top of his voice.

RELATIVE POSITION OF THE SEXES

The position of woman is degraded, but it has become so as an additional attempt to exalt and sustain the superior man. On entering a room he precedes her, and she stands up to address him.

The superior man rarely hurries or exerts himself, because by so doing he risks his dignity. He would be utterly ashamed if anybody caught him jumping a ditch, for example. The superior man must be carried over in a chair or on the back of a coolie. He is horrified at his wife, or, in fact, any woman, doing any undignified thing, such as playing lawn tennis, because, though she is inferior, yet her dignity touches the dignity of her lord.

The character, however, of this superior man has in practical life sadly deteriorated. Through ceremony the soul has practically departed from his conduct and the ceremonial body alone is left. Thieving and lying are too frequently considered as less culpable than the indignity of being caught.

A Chinaman mounts a horse from the right side, and with the right foot, and holds the reins in the right hand—all because he can more easily and safely maintain his dignity, in the doing of these things, by using the stronger hand. When mounted he rides slowly and sedately; never more than at a walk. He stands his horse in the stable with his face outward, because it is more dignified to approach a beast to his face.

If he meets you on the street in undress he will probably pass you without saluting, but later he will return, fully dressed, to confer upon you the proper offices of politeness. Time and trouble are no object in the case. This is his idea of honoring and sustaining the dignity of the superior man in himself and you.

THE ETIQUETTE OF THE TABLE

The guest of honor is placed on the left in China, because in this position alone can the host gracefully and in a dignified manner perform towards him those ceremonial offices of propriety re-

quired on such occasions. In that position he can pick out with his chop-sticks any little tidbit, and either place it on the table before his guest or place it directly in his guest's mouth. If his guest were on his right side this could not be done.

The guest is compelled, by propriety, fairly to gorge himself at a banquet in order to show his appreciation of the feast. He must leave nothing on his plate. He will eructate into his host's face to show his relish of the viands. On entering and leaving, host and guest will keep up the "Gaston and Alphonse" act to weariness, vying with each other as to who shall be the last to pay the offices of politeness.

If his tea or soup should grow cold he will make a great noise with his lips in drinking it, to give the impression that it is hot, so that his host may not be charged, even by implication, with any neglect of hospitality. Tea might be called the formal social glass in China, but the real treat at the meeting of friends in a social chat is pumpkin seeds. Water is never drunk cold, but hot.

Men and women do not eat together, but the employer will eat freely with his employees at the table. By eating with women the dignity of the superior man would be sacrificed. At a wedding the groom is the center of interest. The bride is noticed only as a matter of curiosity. Her feet are of the first interest, because a woman's beauty, to the Chinaman, is in her feet, not in her face.

THE ORIENT VERSUS THE OCCIDENT

The scholar never pares his nails. He never works save with his pencil, and, as he has little use for the left hand, he loves to cultivate long nails on that hand. Scholars with nails ten or twelve inches long are seen. The nails of the Dowager Empress were from four to six inches in length and protected by jade and gold thimbles.

The Chinaman, when puzzled, scratches his foot instead of his head. Many other instances of reversals of western customs can be given, the reasons for which, however, are not so easily discoverable. They are due to custom and environment. Their beds have no mattresses and their furniture no upholstery, but the carving and inlaying are beautiful. Their pillows are hard blocks of wood or little boxes in which the traveler carries his toilet articles and money. They have no stoves, and, in many sections, to keep warm at night the beds are the tops of brick ovens. Where there are no ovens they simply pile garment on garment till they are so solid with clothes they can hardly move. They carry in the hand little stoves in the shape of baskets containing charcoal.

The women wear pants, while the men wear long gowns down to their feet. The vest is worn outside the coat and the soles of their shoes are white and not black.

Although woman is so despised, she has two weapons which give her incalculable power. One is her tongue, regarding which their proverbs are extremely eloquent. The other is her threat of suicide. By this threat a Chinaman is scared into giving his wife anything she desires. We designate our criminals by numbers, but the Chinese so designate their wives as number one and number two wife.

They locate intelligence in the stomach. Their surgeons are outside doctors; their physicians are inside doctors. If a patient were shot by an arrow, for example, the surgeon would break off the pieces outside and the physician would extract the remainder embedded in the flesh. They pay their doctors to keep them well, and punish them, if they can, if they get worse or die. A doctor's fee is called "horse money," because the physician's office is a degraded one. No dissections or amputations can be performed, because the body must pass into the spirit world unmutilated. If the surgeon proposed amputation he would probably be asked how much he would be willing to pay for the privilege.

DELICACIES OF THE TABLE

Fruit left to ripen is considered unwholesome as being too near to decay,

and yet they eat things a thousand times more dangerous. They eat the beaks of birds, the fins and brains of fishes, the entrails of animals, and consider that the claws of tigers, boiled to a jelly, impart strength. The flesh of snakes gives cunning.

Eggs are appreciated according to their age. Those 100 years old, black with age from being preserved in ashes, are great dainties but not uncommon.

Husband and wife are betrothed in infancy. The intended bride comes to his home and becomes a servant to her mother-in-law as long as she lives. No separate family is set up on a son's marriage; simply another addition is made to the house. Thus there are little villages, consisting of a single family, scattered all over China. Some have reached the dignity of cities of a single clan.

Pawnshops are in rich, not in poor neighborhoods, and are only patronized by the well-to-do.

With robbers and beggars they have regular contracts, and the night watchman goes round your house beating at intervals a hollow bamboo to inform the thieves of his whereabouts and at the same time prevents your sleeping, so that *you* may be ready to repulse the thief if he should attack. It is a pretty theory for comfort, surely.

In mathematics their decimal fractions are our vulgar fractions and vice versa. Their denominator is our numerator, etc.

They row a boat standing up, facing the bow, and haul the boat on shore by the stern instead of the bow. They tow by the masthead instead of the bow. There are excellent reasons for these reversals. The Chinaman says we were not given eyes in the back of the head and should see, certainly, where we are going, which our method prevents us from doing. They always write Smith John, and date a letter by the year, the month, and the day, and in these customs they are decidedly right.

THE MARINER'S COMPASS A CHINESE DISCOVERY

The mariner's compass was discovered by them 1100 B. C., and was first used on land. The needle points to the south. Chariots equipped with it were called "south-pointing chariots." Contrary to our mode of expression, they say west-south and east-north.

In contradiction to their own ideas of dignity, however, "the superior man" will play battledore and shuttlecock with his feet and fly kites, while the boys, like old men, stand sedately by and look on. This he does as a method of instruction, and to show the children how the superior man can relax when the high purpose is to entertain and educate the young.

The woman in sewing pushes the needle from her, while the carpenter draws his plane and saw toward him in working, the teeth of their saw being set in the reverse order of ours. Money is divided by weight, and consequently the Mexican silver dollars, which are current, are chopped into bits and handed out as change. They have only one national coin, the "cash," which is of varying value, from one-sixth to one-tenth of a cent.

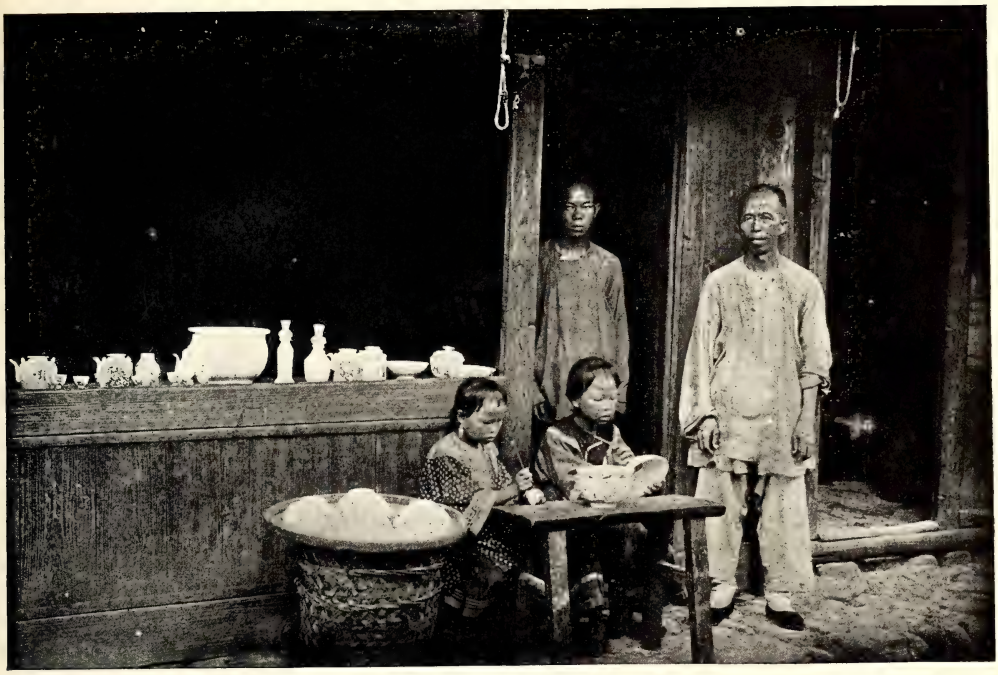
Vegetables, eggs, wood, etc., are sold by weight. In this they are far in advance of our absurd and unjust custom.

Men only have the honor of a funeral granted to them; women, having no souls, are not of sufficient importance. Their mourning color is white. Mourners at a funeral are all hired.

The traveler has constant and annoying experiences of the proverb, "Hope deferred maketh the heart sick." Meeting a fellow-traveler and asking him how far it may be to the next village, he will be told, "Oh, only 6 li." After traveling what he feels must be nearly that and inquiring again, he finds it is now 8 li. The simple explanation is that each traveler estimates distance, not by measurement, but by the difficulties of the road.

In some sections even the axles of their carts are fixed in the wheels and revolve on the body. They can be heard a mile away.

To the Chinaman the foreigner is a boor and a barbarian. It seems a hopeless task to teach him politeness. He



PAINTING THE WARE
In this art children soon become expert

POUNDING RICE
Preparing rice by pounding with a heavy stone

looks upon us as creatures of yesterday. To him China is the Middle Kingdom—not only the center, but the major part of the earth. I once saw a Chinese map of the world; it was three feet square and had a rim all around the edge one inch wide which was marked as the place of the outer barbarians; the rest was the "Middle Kingdom."

The Chinaman wonders why the foreigner leaves his country at all. Is it too small for him to make his living, or has he come to observe the superior people? If so, he is to be commended. But, alas! what a boor he is. What tight and uncomfortable clothes he wears, like the skins of beasts. How vulgarly he eats, and especially what quantities of flesh he devours. No wonder he is blood-thirsty and loves to fight—he has taken on the disposition of the beast. During the Boxer trouble, in the traveling Punch and Judy shows used to stir the people all foreigners were represented on the stage by the figure of a pig. Although fully convinced of our cleverness, he yet looks upon us as we do upon a trick dog. He is finally forced to the conclusion that he must adopt these methods which have made the foreigners so powerful.

THE HIGHEST HONORS ACCORDED THE SCHOLAR

It is difficult for us to understand the amazing hold of these ideas upon the Chinese mind. It begins in the village school. The boy ready to become a scholar is dressed like a Mandarin for his first day; elaborate preparations and ceremonies impress his young mind. His father accompanies him to school, where he bows to the ground before the tablet of Confucius and then before the teacher.

Only a Chinaman can appreciate the permanent uplift the boy receives from the consciousness of his having now entered upon the quest of scholarship. That first impression never fades. That this impression is phenomenally deep, not only on him but on all the people, is manifest by the high honor paid to the scholar.

When the student who succeeds in passing his first examination returns home, every one in his village and neighborhood turns out, dressed in holiday attire, to honor him. Everybody brings him a present and officials come in official robes to congratulate his parents. His household is privileged to erect two tall poles before the door and place a tablet over it stating this to be the home of a scholar.

But the real depth of the seriousness with which the Chinese regard scholarship is shown in the remarkable fact that for five long years, from sunrise to sunset, this school-boy will pursue, under the most discouraging conditions, the study of reading and writing characters, without knowing the meaning of a single one. It is an awful grind, which no human being could sustain save under the most powerful stimulus. That stimulus is the hope of being a scholar and an official.

ANCESTRAL WORSHIP AND THE FEAR OF DEVILS

What passes for religion is simply a conglomerate of ancestral worship or filial piety, mixed with Buddhism and Taoism. Translated into actual life, it is superstition of the grossest and most ridiculous kind. It controls every Chinaman and in almost every portion of his life from birth to death.

It may be truly said that the influence of the dead upon the living is even greater than all other influences combined.

Undoubtedly the early religion of the Chinese was the worship of the true God, the Siong-Te of the present day. That worship is represented by the Temple of Heaven in Peking. There the Emperor, a solitary figure, but surrounded by an imposing retinue of princes and high officials, and as the representative of his people, appears once a year to offer up a whole and unblemished bullock as a burnt offering. On the central stone of a magnificent terraced platform of marble 250 feet in diameter and three stories high, he kneels to offer prayer for his people. No subject is permitted to take part in this solemn act of worship.

The Emperor worships no idols, but makes and unmakes the other gods at will. His is the worship of heaven and means that his imperial authority is derived from heaven and is responsible to heaven. For 4,000 years this solemn act has been performed by each succeeding emperor. When the imperial family fled at the close of the late Boxer trouble and foreign troops entered the city of Peking, the sad spectacle was seen of this sacred edifice, sanctified by the worship of four millenniums (not of course at this very spot), turned into a barracks. Thus were the feelings of China wantonly outraged, and yet people wonder why they so bitterly hate us.

The common people are terrorized by a superstitious belief in devils.

The ordinary Chinaman knows nothing of religious distinctions. His religion is practically an elaborate system of devil worship.

All their gods are deified historical characters. Practically they have no idea of a heaven as we understand it. There is simply a place of spirits without any definite character. Buddhism, of course, describes the tortures of its hell, but Buddhism is only a part of the religion of China.

Rich men by large gifts of money have become the gods the Chinese worship. There are now being erected five new temples to Li Hung Chang, the great modern statesman, who is said to have paid one million dollars for the honor of being a god. Those who have money or property use it more or less lavishly, according to their fears in propitiatory rites, to these gods for favors desired or to purchase freedom from calamity. The Chinese spend yearly untold millions on these rites. It is from these wasteful practices, more than from any other causes, that the miseries of the Chinese come. Their terrors drive them into unparalleled distress. Chinese religious rites cause absolute waste, because millions of property are consumed to ashes in their observance. Until the cruel bands of this devil-worship are broken, China cannot become a great nation. Without money no one has any religious standing. His spirit cannot even reach the spirit world, but becomes a wandering ghost or devil.

They believe that every man has three spirits. These three spirits, in the case of Chinese who are properly cared for at death, have each a distinct place of residence. A fourth order of spirits also exists, consisting of the spirits of the uncared for and unburied dead. These latter are wandering spirits, ghosts, or devils.

The first of these spirits, when a man dies, goes into the spirit world. Once a year all such spirits are liberated for a month to revisit their old homes. During this month tables covered with viands of every description are placed on the street before the door. It is hoped that these spirits, seeing this provision, may be induced to bring prosperity to the family. They believe these spirits partake of the viands.

THE LOGIC OF THE CHINAMAN AND HIS SPIRIT ZONE

A shrewd Chinaman, asked as to this by a foreigner, replied, "Well, I imagine our dead can as easily eat these things as yours can smell the flowers you provide for them."

A spirit's comfort and condition are in exact proportion to the provison made for them by the living. Everything is passed over to the spirit world by fire. At death a ceremony called Hong Tek is observed. A platform, often of silk, is erected, stretched over bamboo poles so as to represent a Chinese homestead. Fields and streams, houses, soldiers, servants, domestic animals, implements, vegetables, grains, fruits, and so forth, all made in miniature, stock it. Before this unique structure, which often costs several thousand dollars, Taoist priests perform the proper ceremonies, lasting three days. The whole structure is then set on fire and passes over for the use and comfort of the dead.

The second spirit does not go into the spirit world, but takes up its residence in the bones. When the time for burial

THE SIMPLEST KIND OF SEDAN CHAIR

arrives, which may be months after death, a live fowl is carried before the coffin to convey the spirit to the grave, and paper representing money is scattered all along the road "to buy the way" from the devils or spirits of the unburied dead, who are everywhere. At the end of five years the body is taken up, the bones cleaned, and replaced in an earthen vessel. This is the proper burial.

Every year the relatives go to the grave to offer provision and pay reverence to this "grave spirit." This is why all Chinamen desire to be buried by their relatives and in China, else their spirits may become wandering devils. For the same reason they make every endeavor to have the bones of their relations transported to China if they die abroad. Prosperity and health are only secured to the survivors by the proper observance of these ceremonial offices.

To the third order of spirits belongs particularly ancestral worship. By elaborate ceremonies the third spirit is induced to enter what is called an ancestral tablet prepared by the family on the approach of death. This tablet is the sacred symbol of the ancient religion of China, which Confucius found existing in his day, 600 years before the time of Christ. This tablet, containing the spirit of the father, is set upon the principal table in the house or is sent to a Confucian temple. In either case all the family pay their devotions before it. This is ancestral worship or filial piety. The Chinese are also firm believers in the transmigration of souls.

The fourth order are the spirits of the unburied dead. They are those which have no friends, no graves, no tablet, and which have never been conducted to the place of spirits. They are an innumerable host, wandering spirits, ghosts, or devils. They are everywhere — in caves, in mountains, and in valleys. They wander through the country roads and in the city streets. They are in stones and trees and houses. They pass through the air only a few feet above the ground. For this reason houses in China are only

STUDENTS OF BOYS' SCHOOL, CHINA: HINGHUA CONFERENCE

permitted to be one or two stories high. Pagoda temples and pawnshops are exceptions by special permission and payment. Here is found largely the objection to railways, telegraphs, and the high houses of foreigners. These things bring actual terror to the Chinese, for they interfere with the flight of devils. Calamities of every kind hang over the neighborhood through these offended devils.

Spirits cannot turn a corner safely; hence all public highways and waterways and city streets are never built straight, but twist and turn. It is hoped by this arrangement that the devils may get confused and lost. For this reason doors and windows are not placed opposite each other, and outside windows are rare, to prevent devils entering. As many intricacies as possible are introduced. The very straightness, therefore, of railways and telegraph lines and all roads built by foreigners is a menace.

In the above conditions lies one of the great secret causes of hatred toward foreigners; for, though the Chinese may actually build these roads and houses for the sake of the money they earn, yet they do so in fear, unless they can find a satisfactory way of counteracting their malign influence. The hatred, however, always abides.

DRIVING OUT THE DEVILS

Taoist priests can buy or drive these devils out, and you find them beating tomtoms through the streets at that work at any hour of the day or night.

Boys, so precious to the Chinaman, are given girls' names or dressed in girls' clothes, or called dogs, cats, or any old wretched things to trick the devils into supposing they are not boys at all. The devils may then think it not worth their while to bring calamity upon them. They certainly have a very poor opinion of the intelligence of these devils.

No journey, no business or social engagement is undertaken without propitiating these spirits.

No grave is located by the astrologers till the proper ceremonies are performed and their permission secured for burial. These burial professors are sent for at death. They live with and must be kept by the family freely and be paid besides. It is their policy, therefore, to prolong their decision as long as possible. Sometimes months elapse before they decide, and in the meantime the body remains in the house coffined but unburied. So superstitious and fearful are the people that, although they are quite aware of the trick, yet they submit to the dreadful imposition.

Not so strange is it that among a people dominated by such beliefs a coffin should be among the best of gifts to a friend. The necessities of such burial rites explain also the fact of the traveling Chinaman carrying his coffin with him as part of his baggage. Coffins are, for evident reasons, made of great thickness, and are supposed to be air-tight. This is, unfortunately, not always the case. Visitors would welcome more careful sanitary conditions.

Shrines are met with everywhere and in the most extraordinary places. Where any bones are found of some one murdered or starved to death, there a shrine is erected and the bones collected and placed in it. There the traveler will pause and cast in a "*cash*" or place an incense stick to propitiate the devil of the deceased.

Property is not devised by will, but is apportioned before the father dies. No such outrage as the neglect of parents can occur in China as with us. Honors, if conferred, are bestowed upon ancestors and not upon descendants. It is a constant subject of wonder why Chinese homes are so often located in such insanitary situations. The cause lies in the same fear of devils. The owners imagine themselves more likely to be free from their visitations, as they think the devils may not consider it worth the trouble to look after such wretched people.

The very reverse is the case with their graves. These are the residences of their ancestors and nothing is too good for them. The beautiful breezy hillside

having the finest outlook is chosen. The tombs of the sages are in fine groves of beautiful cypress trees.

Temples receive far less attention than graves, and, as they depend on voluntary support, in the majority of instances are often allowed to fall to decay.

Priests in China are classified very low down in the social scale. The Chinese proverb states that "when the priest and temple come to town morals fade." Priests and their sons are not allowed to become scholars.

The son is the climax and supreme desire of the family, because only a son can render the proper service to the father's spirit. For this reason female children are not welcome and infanticide is frequent, but always of the living child, necessarily; otherwise a son might be slain.

WHAT MONEY WILL DO

The rich Chinaman, if condemned to death, easily procures a substitute. Some poor wretch without money to secure his spirits from becoming wandering devils, with the price of his miserable life can purchase proper care for his spirit. Anything, in fact, can be done if you have the money.

It is this belief that causes the Chinaman to commit suicide by taking his life on the premises of his enemy to take vengeance on him. His spirit, he believes, will forever haunt him. There is another reason also: he knows that as sure as fate the officials will under such circumstances come down upon his enemy and strip him of everything.

Poor Chinese have been known to sell everything they possessed, tear down their houses to sell the timber, sell or rent out their wives and children, and even sell themselves to procure money for the proper rites for the peace and comfort of the ancestral spirits. One thing alone he will not do, namely, sacrifice his son.

At the death-bed, where with us the hush of sorrow reigns and affection brings silence, the awful beating of drums, the crash of cymbals, and the tumult of fireworks hold carnival to frighten away the devils who are tormenting the dying and causing death.

China, rich and picturesque, with climatic conditions ranging from the Arctic to the Torrid Zone, has an unrivaled history of over 4,000 years. Her discoveries and accomplishments cover—

Arches in architecture, carving in wood and moulding in bronze and other metals, painting with unrivaled colors, printing, paper from wood pulp, the mariner's compass, gunpowder and guns, books, astronomy, public assembly codified laws, civil service examinations, bank notes and coins, and heating houses by hot-air pipes carried from a furnace. All of these she possessed centuries before they were dreamed of in the West.

Travelers find salt mines 2,000 feet deep, crudely sunk by two generations of laborers.

Her mighty rivers, some of them 3,500 miles in length, have been so connected by thousands of miles of artificial canals that this land is a perfect network of waterways.

Her economists saw stability and equality in a proper division of the land among the people, in making labor noble, and in taxing the owners of unproductive land. To this day the Emperor, with great ceremony once a year, with a golden-handled plow turns up a furrow of land to point to agriculture and give labor dignity.

Although China's government is an imperialism, yet the Chinese people have always acted in opposition to the maxim of the divine right of kings. They have held inflexibly through the centuries that every man has an inalienable right to free thought and speech. They have always tolerated any and every form of religion, so long as it did not interfere with or in any way imperil the authority of the state.

EXALTED IDEALS EMBODIED IN THEIR PROVERBS

No people are less riotous or more amenable to the voice of reason. A Chinese mob, more than any mob, can be influenced, subdued, and made ashamed by a reference to the teachings of their

fathers, producing in them such bad manners. When other people dressed in rude garments, they were clothed in splendidly colored silks of their own manufacture, colors which have never been excelled to this day.

A distinctly religious and keenly intellectual people, they have passionately loved harmony, and have shown themselves capable of high thinking and modest living.

Diligent, also, they are to the last degree. Men and women slave from sunrise to sunset. Even the Emperor himself will frequently hold audience with his ministers at 3 or 4 o'clock in the morning.

China's contact with the West during the last three centuries has been most unfortunate. On our part it has been coercion, attack, and grab. We have despised her people and disregarded her rights, while demanding her trade at the point of the sword. Her age, her thought, her isolation have made her conservative and proud. We have tried by force to hurry her, and by shot and shell have compelled her to open her gates. Degrading superstition has made her suspicious, and the struggle for bread has made her intensely material. Still her superstitions have kept before her eyes the unseen, and possibly have made her people really less materialistic than ourselves. The Chinese deny themselves far more for their religious beliefs than do we. We should not forget that our better knowledge of the unseen, our clearer apprehension of religious truth, came from the revelation of the Bible, the foundation on which our higher civilization is built. In its possession we have, as a race, little of which to boast. To us it is a legacy from another ancient people, the Jews. Peculiarities as strong and characteristics as great as those of that ancient people are among the valuable possessions of the Chinese.

If we seek their favor only for purpose of trade we shall make no advance in their friendship. The proverbs of their sages, familiar even to the lower classes of China, are full of warnings against precipitately encouraging that form of friendship. They are keen to discern motives, and appreciate high and noble ones in others, however much they seem to be lacking in themselves.

The lessons of China's history, unlike those of Egypt, Greece, and Rome, are not dead monuments, but living experiences in a great and living nation.

China, though sustained by her material resources for 4,000 years, has hardly touched her wealth. Living on the products of her own labor for 40 centuries, her riches are today almost intact and equal to our own. In this marvelous fact are to be found rich lessons for political and social economists.

BOOK REVIEWS

The Great Wall of China. By Dr William Edgar Geil. Pp. 390, 7 x 9 inches. 100 illustrations. New York: Sturgis & Walton Co. $5.00 *net.*

The account of this expedition through the heart of China, along the Great Wall from the Yellow Sea to Tibet, is most interesting and of great value. Particular attention has been given to illustrating this volume, not only to substantiate the text, but to make material additions to it, so that, in many instances instead of long detailed descriptions the photographs furnish the information without encumbering the work. Not only is there an interesting geographical, historical, and legendary description of this vast project, but Dr Geil has set forth from his wide knowledge of Chinese literature much that is to us new concerning the country and the people.

A Summer in Touraine. By Frederic Lees. Pp. 318, 6 x 8½ inches. 100 illustrations. 12 color plates. Chicago: McClurg & Co. 1909.

The banks of the Loire, Vienne, and Cher, those parts of central France richest in natural beauty as well as in historic memories, are here described as they appear to a leisurely traveler, who sees, as he passes along the river banks, and wanders through the old chateaux, the whole pageant of the Renaissance in France. Starting from the once royal city of Blois we visit the typical towns of older France, so rich in historic passages. Then at Tours we renew acquaintance with Balzac, and in the country around see the original settings of much of "The Human Comedy." Mr Lees, however, gives definite information for the present-day traveler who wishes to see the most of Touraine, as well as historic insight for the fireside traveler, who will find every notable chateau represented in Mr Lee's photographs.

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THE NATIONAL GEOGRAPHIC MAGAZINE

IMPRESSIONS AND SCENES OF MOZAMBIQUE

BY O. W. BARRETT

With Photographs by the Author

A COUNTRY as big as the Atlantic States from Florida to New York, with the capital near the southern boundary and half a dozen smaller towns scattered along the coast; more than 3,000,000 inhabitants, of which only about one per cent are whites; one of the oldest of all European possessions and one of the richest in agricultural possibilities, at least, but one of the least known countries in the world. Such is Mozambique.

Four or five good ports and as many bad ones; five towns and a small but up-to-date capital city, and a generous number of military posts and outposts, a few of which are in the real raw interior; millions of acres of the finest alluvial soil fairly aching to show the farmer what big crops may be grown; waterways like the Zambesi, the Limpopo, and plenty of smaller ones to allow cheap handling of products; no deserts, no salt sinks, no large swamps, no mountainous wastes, no impenetrable jungles; out of some twenty only one or two tribes that object seriously to paying taxes to the government, now that they realize that the tax collector is a vital organ of the white tribe, which objects to any one tribe exterminating another in the good old way; for, wicked as a bush policeman tries to be, he must needs fall far short of the unrestrained chief's "induna".

The early history of this strange section of East Africa should not be, even if it could be, written. We know the old-time black was as bad as a barbarian can be, and the endless tale of persistent, widespread, and continuous butchery would not be good to read.

Yet the ethnologist may well listen to the half legend, half true stories of the clans, tribes, and races that have been lost forever. No pottery, no carvings, no ruins will remain after a few more years; only language traces (for the slayers sometimes spared a few of the comeliest maidens) and father-to-son oral history. To ride over the site of a native village which probably held a thousand huts less than twenty years ago, to note the bits of charcoal, pieces of clay bowls, bones, and the few ominous breaks in the heavy ten-foot stockade fence made of hardwood logs set upright close together, forcibly reminds one of the wretched people, tired of fighting, who sought to gain respite by erecting a barrier that no foe could burn or climb over, only to

GRASS AND PALM-LEAF COSTUMES WORN BY THE NEWLY INITIATED BOYS IN A M'CHOPI CIRCUMCISION CAMP

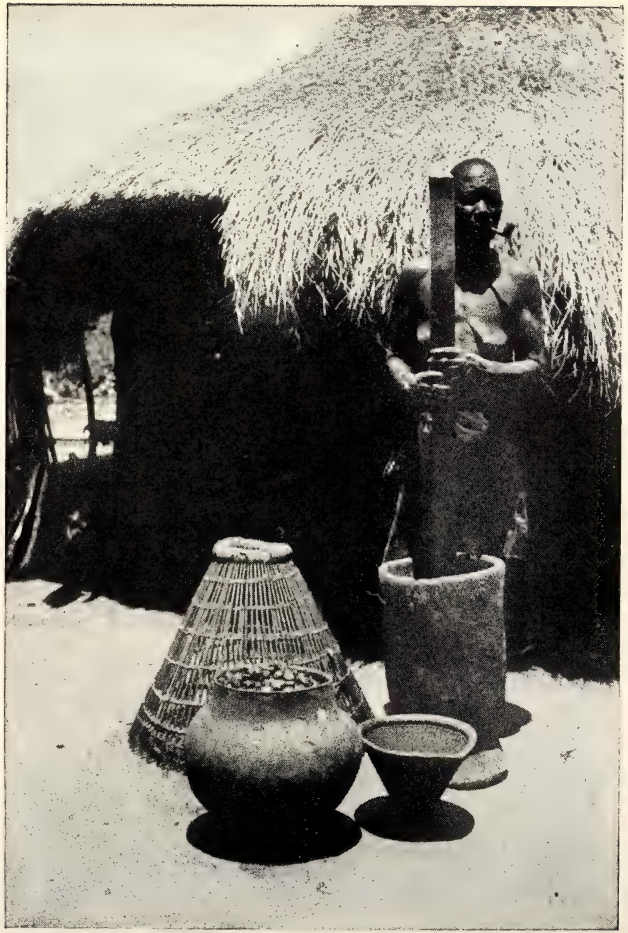
This costume is the first one worn after the completion of the ceremonies which require a week or longer in the camp, and is said to be necessary to prevent the great danger which would result to all parties concerned should any woman happen to see the person of the new member. The striped pole with a rattle at the tip is in evidence beside the doorway of each hut, which is the temporary home of the boys during the initiatory period.

ANT-HEAP IN SISAL HEMP PLANTATION, MOZAMBIQUE

These termite nests are dangerous but necessary evils in the plantations. The cost of tearing down the heaps, sometimes 20 feet high, is greater than the damage the insects do to the crops. After the removal of the timber the colonies gradually starve to death.

KAFIR BOAT MADE FROM MIDRIBS OF PALM LEAVES BOUND TOGETHER: MOZAMBIQUE

Kafirs bringing maize from the hinterland to the Limpopo River for export. The women carry about 60 pounds at a trip; the journey requires from 2 to 6 days. They usually travel in parties of 3 to 10 or more.



Old Ronga (Kafir) woman with wooden mortar and pestle for husking rice, pounding maize, etc. Near Lourenco, Marques. Fish trap in background.

KAFIR CORN AS GROWN BY KAFIRS IN SOUTHERN MOZAMBIQUE

Height, about 15 feet; grown without fertilizers or "machine cultivation"; soil, 27 feet deep

perish some hot, red day amid the frightful "ooogh-sh!" cries of the enemy as their dripping assegais were thrust through and through the dying and dead.

The Zulus have had for centuries a superstitious fear of salt water, and so, when Chaka, Dingaan, and their brother fiends had devastated practically all the country between Zululand and Inhambane, wiping out kraals and even whole tribes by scores, they came to a long chain of lakes (the lower Inharrime) parallel with the coast, and there they stopped, thus saving one tribe of true, pure-blood Kafirs who had fled over onto the dunes and low, bushy hills between the "rosary" of brackish lagoons and the Indian Ocean. This tribe, the M'chopis, is the purest if not the only unmixed Kafir tribe now in existence.

HUSKY HAMMOCK CARRIERS: THE HAMMOCKS APPEAR IN THE BACKGROUND: MOZAMBIQUE

FORDING A BRANCH OF THE SLUGGISH, MIRY RIVER NEAR THE ZAMBESI

The "mashila" or hammock poles are raised from the shoulders to the heads of the carriers to avoid wetting the passenger. A lion devoured a native on the further bank shortly after our party had passed.

At Quesico we had the good fortune to witness a batuque, or ball, lasting nearly three days, at which about 3,000 fine specimens, mostly adults, were present. To describe the weird minor music of the marimbas, or huge xylophones, the blood-freezing death chants, the thrilling war songs, the "expression" dances of both women and men, and rites and divination ceremonies which the witch doctors were induced to show us would require much space. Many of these things could not have been seen by strange white men except that the commandante, Lieutenant Alves, the authority on all M'chopis [Mtyopi] matters, had the full confidence of the chiefs; and, besides, there were other more material inducements in the shape of feasts and presents.

At Inharrime, near Inhambane, we saw another grand batuque, with 3,500 Landims, M'chopis, and Bitongas. Here 200 native "pianos" kept up an incessant din for 36 hours. The "tunes" varied with the tribes. The Portuguese national air was executed pretty well by several of the bands, who had picked it up from obscure sources.

Each key of a marimba has suspended loosely beneath it a hollow gourd as a resonator. All but the smallest of these resonators have one or two apertures covered with the stretched membrane from a bat's wing. The membrane itself is protected by an artificial rim of wax, and this membrane continues to vibrate for several seconds after all sound from the key and resonator has disappeared. The particular orchestra shown on page 829 had learned to play the Portuguese national air very creditably, but when attempting "God Save the Queen" it became evident that the memory of each

WASHING, BATHING, AND FILLING POTS AND GOURDS WITH DRINKING WATER SIMULTANEOUSLY: MOZAMBIQUE

INSIDE THE COMPOUND WALLS OF A COCOANUT ESTATE OF THE COMPAGNIE DU MADAL IN ZAMBESIA
Unhusked nuts by the hundred thousand are collected here to be opened, the "meat" dried into copra and shipped to Marseilles

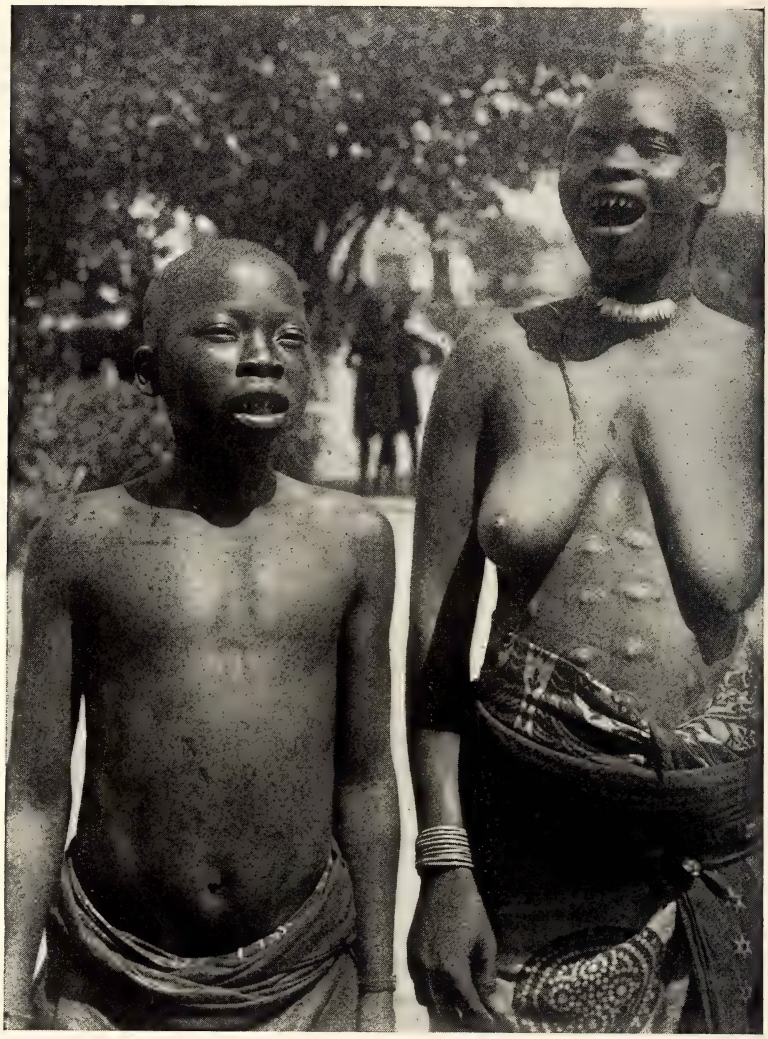
KAFIRS OF THE RONGA TRIBE, UMBELUZI VALLEY, SOUTHERN MOZAMBIQUE
The ubiquitous 5-gallon kerosene tin is in evidence

RONGA KAFIRS: UMBELUZI

YOUNG KAFIR GIRLS, UMBELUZI: WORTH $25 TO $50 EACH: FILED TEETH RARE

NATIVE CANOES MADE OF BARK (BRACHYSTEGIA): MOZAMBIQUE

The section of bark is carefully removed from the tree, the ends folded in, and all seams and cracks caulked with native pitch



FILED TEETH OF THE M'CHOPI NATIVE

This custom is practiced by comparatively few members of this tribe and is undoubtedly in imitation of some of the tribes of Zambesia. The woman being usually right-handed, prefers to carry the child on the left hip, where it is not so much in the way while at work; hence the left breast is usually slightly elongated.

player was decidedly inadequate to the feat. All the notes from whatever style of marimba are in the minor scale. This form of musical instrument appears to be used only by the M'chopi tribe and their immediate neighbors, who are only poor imitators. The drum-stick carries a lump of native "landolthia".

The warriors in the dance, who may number 300 or more, constantly drop in their tracks and pretend to be smitten with death. The witch doctor then passes around, sprinkling them with medicine, whereupon all gradually resume their places and the dance continues. This dance is said to be as old as the tribe, which is probably the oldest Kafir tribe in East Africa. Their language is quite

KAFIR DRUMS AND RATTLES: THE ROAR OF THESE HUGE DRUMS CAN BE HEARD TEN MILES AWAY

distinguished from that of any neighboring Kafir tribe, and many of their customs are also peculiar. About 25,000 individuals are now in existence. They have the best "shambas" and take the most interest in agriculture of any known native tribe in East Africa.

The young girls' dance of the M'chopi tribe requires several years' practice before the difficult poses and contortions can be successfully performed. Several ankle rattles may be seen worn by the girls at the lower left of the picture on page 828. These hollow spheres are made of palm-leaf or grass, if not young gourd fruits, and are partially filled with large seeds, pebbles, etc. The noise of these ankle rattles is supposed to assist in keeping time in the dance. This is probably a Zulu custom, and even today in civilized Durban the ricksha boys frequently wear similar ornaments.

The tribes meet but do not mingle. Here we saw grave old M'kumbi, who has an income of $50,000 from the 10,000 huts of his tribe.

On the Zambesi, at the head of Chinde, I counted eight hippos at one time around the boat. Since the natives are not supposed to have guns of any sort, and since few devastating tourists pass that way, these uncouth monsters may endure a few years longer. There are usually to be seen one or two pairs in the Inkomati River, some three hours from Lourenço Marques, the capital. Feet a foot across and a body as wide as a wagon—no wonder the poor native sits up nights beside his corn-field when he hears the ominous "woo-uff" of an old tramp bull in the neighborhood.

Near Mopea, three days up the Zambesi, we passed through two small native kraals in which the lions had eaten 18 people in three months previous. It is quite impossible to hunt these man-eaters on account of the tall, rank grass (four to six feet high), and, since they soon

AN ORCHESTRA OF MARIMBAS: MANY VARIETIES OF THESE UNIQUE XYLOPHONES WITH HOLLOW GOURD SOUNDING BOARDS ARE USED

THE "MARIMBA" OF THE M'CHOPI TRIBE IN THE STATE OF INHAMBANE, PORTUGUESE EAST AFRICA

The resonators are made from a kind of wild gourd attached beneath the xylophone keys. One or two apertures in the side are covered with the membrane from a bat's wing, fixed with gum, so that a "snarling rattle" is produced, even continuing several seconds after the sound within has ceased. These gourds vary in size from 6 to 40 centimeters in diameter. All the notes are in the minor key.

learn that two or three cuffs will make a big hole in the side of an ordinary hut, the poor native must roost high or die.

Even Major Kirby, the famous lion hunter, has not been able, he tells me, to average one lion per month during his stay in the Boror Company's estates, where over 100 people were devoured last year.

In the Zambezia district there has been spent a large amount of money in agricultural experiments, and, though the results are not encouraging thus far, it is no fault of the land. I have never seen any soils quite so rich, apparently, in either temperate or tropical America as are to be found in the Zambesi, Limpopo, and Inkomati alluvial plains. The colonization laws are pronounced excellent, even by English colonials. They are automatic—just to the government, to the colonist, and to the natives. And here I may say that it seems to be agreed by men who know that nowhere else in Africa is the native question so well managed as in Mozambique. But it is a very big and deep and difficult question.

During our trips, covering some 250 miles on mules, 125 with hammocks, and 1,000 in boats, we came into touch with at least 500 natives as bearers and quasi-police guides; but not one thing was stolen during the ten weeks' travel, and never was it necessary to punish a "boy" for any misdeed. The 50 to 75 loads, 30 to 50 pounds each, were mostly pack-

HAND-DRUM ORCHESTRA OF THREE PLAYERS IN THE ZAMBESI DELTA

Both the bare hand and a short drumstick are used in producing the weird but highly variable "music." A carved image on a post presides over the occasion

WAR DANCE OF THE M'CHOPIS: FEIGNING DEATH TO BE REVIVED BY THE WITCH DOCTOR (SEE PAGE 818)

MASKS USED BY SOME OF THE WARRIOR DANCERS

WOMEN'S WAR DANCE: QUESICO, MOZAMBIQUE: THE HEAD-DRESSES ARE OF OSTRICH FEATHERS

MODERN COIFFURE STYLES IN MOZAMBIQUE

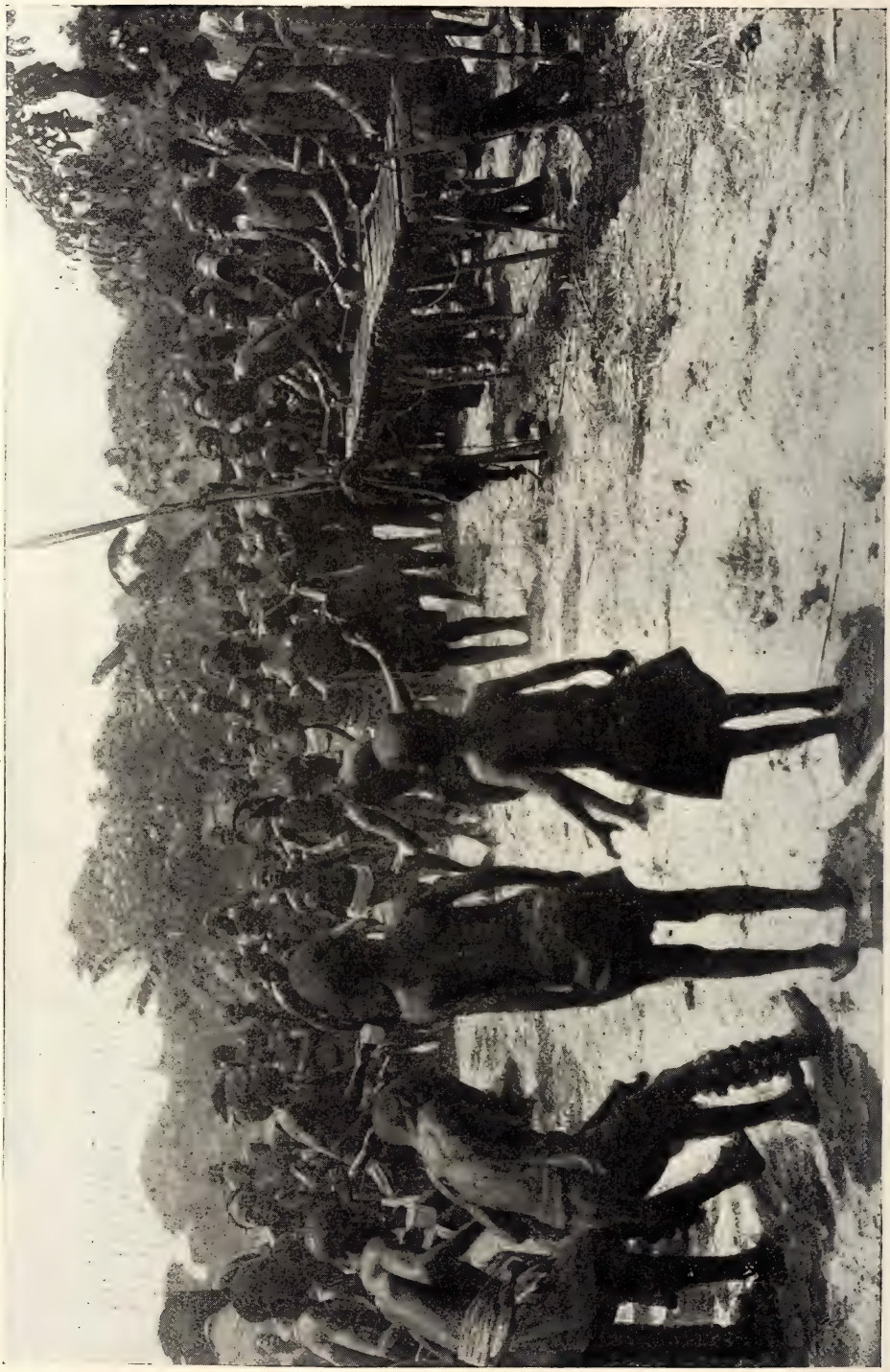
The arm decorations are antelope and ox tails; two of the women carry much-prized head-dresses of black ostrich feathers; the anklets are of brass and steel wire with the exception of one which was made of beads strung on hair. This scar tattooing is practiced very largely by the M'chopis, and is imitated to some extent by their neighbors. However, the lower tribes do not usually make so large nor so thick a bosse as the M'chopi women. The M'chopi tattooers use one or more native resins to rub into the fresh surface of the cut to stimulate the growth of scar tissue. Consecutive semi-circular cuts are preferred. The bosse or point in the center of the scar mass is sometimes one-half an inch thick. There seems to be little design among the M'chopi tribe in the arrangement of these scars, which extend from a line just below the breasts to just above the knees.

THE PRINCIPALS IN THE MANY SYMBOLIC DANCES OF THIS LITTLE-KNOWN TRIBE

A WITCH DOCTOR

CEREMONIAL BOWS USED IN WAR DANCE BY THE M'CHOPI NATIVES OF SOUTHERN MOZAMBIQUE

The M'chopis are the oldest and yet the purest of all the Kafir tribes. They were saved from extermination by a saltish river, the Inharrime, across which no Zulu warrior would go, thinking it an arm of the (tabooed) sea



THE YOUNG GIRLS' DANCE OF THE M'CHOPIS

Note the rattles above the ankle of one of the girls (see page 819)

The din from this triple rank of marimbas was overwhelming. Only a small portion of the 200 "pianos" forming the orchestra can be seen

THE WOMEN'S WAR DANCE AT QUESICO, MOZAMBIQUE

ages filled with things dear to a native's heart and easily pilferable.

Neither were any acts of cruelty nor of indecency witnessed on the whole trip, except on the part of the whites. The farther away from civilized centers we went the more *respectable* became the native.

Thousands of "black ivory" specimens are exported to the gold and diamond mines of the Rand; they return with money, disease, discontent, and bad morals. The young men from Gazaland and Inhambane go on contract for say one year to get money to pay the hut taxes and to buy one or two wives. Instead of paying for a wife with cattle, as formerly, before the terrible ravages of rinderpest and "East Coast" fever, sterling gold, £10 to £25, must now be cashed down to the father before the union is legal or the bride enters the new hut.

With diseases which practically preclude the breeding of all domestic animals but the pig, it is no wonder that the rich lands are so very little cultivated. But the steam plow has put in its appearance and as soon as permanent regulations for sale or rental of land are promulgated the country should be a happy harvesting ground for planters. With labor at $2 to $5 per month, good transportation, no more sickness than in any other country, perhaps, and good support from the government, colonists will come and then Mozambique will gloriously come into her own.

THE LOST WEALTH OF THE KINGS OF MIDAS

By Ellsworth Huntington

IT was the lazy hour just after noon in the square, sunny court-yard of the great khan at Eregli, the present terminus of the Bagdad Railway. A line of round-topped, long-bodied wagons, black or white, was drawn up on one side of the yard, while on the other a group of travelers and guests squatted on their heels in the shade, rehearsing the time-worn gossip of the ages.

Now and again a wagoner in skin-tight trousers and a girdle reaching nearly to his armpits stirred up the buzzing flies, as he sauntered to the well in the midst of the hot court to draw water for his patient horses.

The "odabashi", or "chief of the rooms", emerged from the steamy atmosphere of the coffee-seller's shop beside the wide street door, and went aloft to a flagged porch on the second story, bearing on his uplifted hand a tray laden with blue bowls of curdled milk, flat cakes of bread, a plate of cool, insipid mulberries, and some tiny cups of unsweetened coffee thick as pea soup.

Through the outer door one caught a glimpse of the inevitable oriental bazaar, where peasants in dirty white drawers bargained with leisurely merchants in baggy blue trousers, who sat contented in their little shops selling cloth, raisins, peas, rice, and strange brown substances with lingering, indescribable odors. Turks, Greeks, and Armenians were there, but not a man of any race showed signs of haste. Why should a man hurry at noon of a summer's day with the thermometer over 90? or why, in fact, should he ever waste the precious hours of life by haste?

The stillness was broken by Luiso, the wily Greek wagoner, whom I had hired to drive me out into the Axylon, the great dry plain which occupies the center of Asia Minor north of Eregli. He looked very clean, as he reported that he had been to the public Turkish bath at my expense, according to orders, but he could not see the sense of such a proceeding, for he had been there only two months before.

LIBERTY FROM A SOLDIER'S VIEWPOINT

Early the next morning we started off, accompanied by a mounted gendarme, a needless encumbrance taken to add to our dignity. He was a gruff old Turk, who soon began to grumble about his wrongs.

"What's all this talk about liberty and a constitution?" he growled. "Look at my gray hairs. Haven't I served the government faithfully for 40 years? And now, just because there's liberty, little boys with piping voices are put in our places—mere school boys, 17 or 18 years old, with soft cheeks, who cannot even raise a mustache. They can read and write and all that, but what do they know? When they have to ride 10 hours with the post some night they don't even know the road, and shiver and shake like frightened women. What's this liberty good for? It hasn't brought me the 20 months' pay that the government owes me, and now I shall be thrown out to starve because they say we old men make the villagers support us. Hasn't a man got to live? I don't want liberty. I want to be free to get a good living."

Thus he talked as he rode beside the wagon through the pretty gardens of the oasis of Eregli, past the miles of reed-beds which form the miscalled Lake of Ak Gyöl, and out into the great dreary plain of the Axylon. When he fell behind for a space the Greek took up the complaint, and said that liberty might be all right, but so far as he could see it was liberty for the Moslem and not for the Christian.

WHEN PROSPERITY RULES

Everywhere we found the people of Asia Minor wondering why they are poor, and why this new liberty of which all men talk, but of which no man knows anything, does not make them prosperous.

We, too, had often wondered why this land, where Midas turned all things to gold and where Crœsus was richest of mortals, is now so poor, and it was largely to study this problem that we had come back once more to Asia Minor.

During the past two years Turkey has experienced a wonderful transformation. The new régime has not brought all that the ignorant expected, but it has done much in spite of the complaints heard on every side. Back of the present low estate of Turkey, however, there lies a train of centuries of gradual decay, and this it is which renders the task of regenerating the empire so difficult. Since the days when Asia Minor was in her prime, 2,000 years ago, something has surely changed. Is it the race of the inhabitants? Is it their religion? Is it the government? Or is it nature herself? The change cannot be due purely to the coming in of the Turkish race, for the majority of the people of Turkey, although Turks in name, are not such by blood. Moreover, although the Turks have many faults, few thoughtful persons who have lived in their country will deny that under favorable conditions it is hard to find any people more sober, peaceful, and industrious. Nor is the change from the prosperous conditions of the past wholly a matter of religion, for Mohammedanism can scarcely be considered worse than paganism. So long as prosperity is the rule, Mohammedans and Christians get along admirably, but trouble arises at once when there is poverty or distress. Nor is the government responsible for all the decay in the civilization of Turkey, for today the worst conditions are found in just those places where the government has least authority; for instance, among the Arabs and Kurds. Beyond question the country has suffered deplorably from racial weaknesses, from religious dissensions, and from governmental oppression; but back of these and ever aggravating them, and sometimes causing them, lies another factor—a change in nature herself.

Nomadization, so wise men say, has been the bane of the Turkish empire. Vast areas which once were prosperous agricultural districts have now been given over to nomads and their flocks, and this has led to disorder and to the breaking down of the ancient high civilization of the land. It has often been said that nomadization is a result of the racial character of the Turks, and such is the common statement in histories. The observations which we made during the work of the Yale Expedition of 1909 throw much doubt on this assertion, and make us believe that nomadization is largely due to a change of climate. It was the study of this problem which led us out into the dry plain of the Axylon, lying at a height of about 3,000 feet above the sea. It occupies many thousand square miles in the center of Asia Minor within a great ring of peripheral mountains which border the coast and keep out the rain.

HOSPITALITY A TURKISH CHARACTERISTIC

Our first day's ride came to an end soon after 2 o'clock, at a sad adobe village of dingy gray set in the midst of a smooth brown plain of fine-grained lacustrine clay. A parching south wind had raised the temperature to 101 degrees Fahrenheit, and the heat was so oppressive that we all lay down to rest in the mud guest-room.

After half an hour my drowsy thoughts were interrupted by a plaintive childish voice which seemed to be addressing some one who would not answer. After it had spoken two or three times I perceived a dirty, rosy little youngster standing in the middle of the room and timidly inviting the sleepers to drink coffee, while his mother hid her face in her veil and peeked in at the door. When I had drunk the contents of one of the little cups down to the half-way line, where the beverage becomes solid

A CART ON THE BORDERS OF PHRYGIA

A CIRCASSIAN WATERING CART, MADE OF A SINGLE LOG, IN THE MIDAS VILLAGE

THE TOMB OF THE KING OF MIDAS (SEE PAGE 841)

grounds, the child would not be satisfied until I said that it would be all right to put down the cups for the others to take when they awoke. He had been so well trained in the hospitality which is almost universal among the Turks that at the age of five he felt greatly distressed for fear he might fail to do his duty as a host.

SENTINELS OF THE DESERT

For the next week or more we rode across the vast barren plain. On the edges it is diversified by ranges of volcanic mountains, while from the plain itself symmetrical brown cones of extinct volcanoes rise to flat tops, in which lie gracefully rounded craters. Near Kara Punar we came to an odd type of volcano. The plain is composed of ancient lake deposits, which have been consolidated into a soft marl alternating with sandstone of a grayish brown color. In these deposits a hole a mile or more in diameter and nearly 200 feet deep was formed many thousand years ago by a volcanic explosion. In the middle of the hole a cone of slag and scoria was built up until it rose well above the level of the plain. When the internal forces of old Vulcan ceased to act, a pretty cup of a crater remained in the top of the cone, while at its base an annular depression surrounded the cone and was itself surrounded by the gray cliffs of the lake deposits. Today the depression is occupied by a lake, narrow and ring-shaped and very salty. In winter the lake fills up to a considerable depth, but during the long rainless summer evaporation reduces its size and causes the water to become so concentrated a solution that much salt is deposited.

VALUABLE SALT DEPOSITS

In May salt-gatherers arrive and keep on working for about two months, when the water is almost gone and the deposits begin to contain not only common salt but other distasteful chemical compounds.

As we came to the edge of the hollow and looked down at the annular lake a strange sight presented itself. The lake was so far dry that part of its ring was waterless, and was covered with green reeds; another part was white with salt, and still another contained muddy blue water ringed around with white salt, outside of which was a ring of green reeds. Back of the reeds in the center rose the black and red slopes of the volcano, while on either side stood the steep gray and brown cliffs of the lake deposits. In the large pond at the foot of the slope below us 40 or 50 men were wading knee deep, or were stooping to get hold of something at the bottom of the water. In their hands they brought up great masses of dainty square crystals of salt, which they placed in little piles whose tops touched the surface of the muddy pond. When each man had gathered enough he brought a sieve like an ash-sifter and used it to carry the salt ashore, and piled it up among the reeds in glistening little cones from two to four feet high, shining white as snow against a bright green background.

It is hard work to gather the salt, for the constant dipping of the hands into the briny water and the rubbing of the finger-tips upon the mud of the bottom soon causes sores. A man can work only from four to six days at a stretch, after which he must let his hands rest a few weeks and get well. An industrious man can earn high wages, however—80 cents a day if he is very energetic—so there is no lack of laborers. The salt works are owned and run by the government, which sells the product at the rate of about 10 pounds for 8 cents.

HOW THE LOWLY LIVE

In order to see as much as possible of the life of the people, I traveled as the natives do. Each morning we started soon after 5 o'clock, in the cool beauty of the dawn. Sometimes we ate a little bread before starting, and sometimes took a bite in the wagon. There was no real meal, however, until 10 or 11 o'clock. Then, as the heat grew great, we stopped at one of the clusters of from six to a dozen houses which sprin-

kle the plain at intervals of 3 or 4 miles. They are poor little hamlets, composed of houses of mud or stone, just high enough to allow a man to stand upright.

Not a scrap of green relieves the brown monotony, except in one or two cases where some industrious soul carefully draws water from a deep well and daily waters a few sorry vegetables enclosed within a mud wall.

At first it puzzled me to know how the soldier always picked out the guest-house with unfailing accuracy. I soon saw, however, that the guest-house, which, like most of the houses, consists of only a single room, never has hay stacked on its top. Also, it is regularly located a little to one side of the main body of the hamlet, in such a position that the guests, as they ride up, may not pass close to the other houses, nor, as they sit in the cool of the evening before the door, be tempted to admire the women on their way to the well for water.

On arriving at the door of the guest-house, one merely goes inside and sits down. By and by a boy or man appears and says, "You came well," to which one answers, "We found things well." Then the villager roasts coffee over a fire—unless he has some old and much-cooked grounds on hand—pounds it in a mortar, boils it, and offers the guest a drink. If one stops at a guest-house in the afternoon, nothing more happens until evening, except that the men drop in one by one to hear the news, as the word of the presence of strangers spreads to the fields and herds. If one stops at 10 or 11 o'clock in the morning, however, nothing but patience is required in order to get a meal of the best that the village affords.

TURKISH DISHES

Sometimes we had bread fried in fat; often we were regaled with cracked wheat, also cooked in fat, or with a dish of fried eggs, to which flour was added with a liberal hand to soak up the grease. By way of relishes the richer folk sometimes brought us summer squash or egg-plant stewed with butter, or a mess of greens raised in a tiny garden plot and watered with infinite pains.

The dish which stays longest in memory is "airan"—thin sour milk, in which floated small cubes of cucumber and a few tiny bits of raw onions, which had been grated into it to give it a cooling flavor.

When the traveler has eaten his fill, more coffee is served, the hosts go about their business, and the traveler is left to sleep a little or to resume his journey. Payment is not asked nor expected, and even to offer it is in many places regarded as discourteous.

The little hamlets where we stopped day after day are all occupied by Turks, who lead a semi-nomadic life. Flocks and herds are their main reliance, but for a mile or two around most of the hamlets the higher parts of the country are planted with scanty crops of grain, chiefly a peculiar red wheat, which was being harvested at the time of our visit, in early July. Almost universally the wheat seems to be planted in the very dryest, highest places, while the relatively low places, where there is a fair amount of water and a hint of green grass, are not tilled. Luiso, the wagoner, noticed this and had much to say about the stupidity of people who let good land lie waste and threw away their time in trying to raise crops where nothing would grow.

AGRICULTURAL POSSIBILITIES

Near Lake Tatta, the large central salt lake of Asia Minor, we rode for days over a comparatively green plain with running water in various places, yet without cultivation. Here the strictures of the Greek reached a high pitch of irony. "Look at these idiots," he said. "Just put some Greeks here, or some Muhajir Turks—that is, immigrants from European Turkey—and see what beautiful farms and gardens they would make. These people are fools to live in poverty and wander around with their cattle when they might live in one place and be rich."

It almost seemed as if he were right.

HEAD OF A COLOSSAL LION, FALLEN FROM A TOMB OF THE DAYS OF MIDAS

The outline of jaws and head may be more clearly seen by turning the picture on end

The crop of 1909 was so poor that in many places it was impossible to cut it with scythes or sickles. The only recourse was to the painfully laborious method of pulling the grain up by the roots. The season was so dry that many people did not get back even the seed they had planted. Those who got two bushels of grain for one of seed felt satisfied, and those who got three congratulated themselves. Often this same thing happens, and generally there is a period of perhaps five or six years out of every thirty when the crops are flat failures. At other times they are often poor—so poor that no people who were not very industrious and very much in need of the scanty harvest would take the trouble to reap them. Yet the Turks of the Axylon do not cultivate the moist, green parts of their plain. Instead, they depend upon their animals and change their habitat at least twice a year.

In winter they live in large villages, usually at the foot of the mountains, or in some other location where there is an abundant supply of drinking water. There they gather for five months for the social season, from November to March. One such village which we visited contains about 600 houses, each one with a huge stack of greenish-yellow hay on its flat roof and a few sheds and yards about it. The place is called Sultan Khan, from the magnificent ruined Seljuk khan or inn, with an exquisite façade of varied marble, erected in 1277 A. D. A place with a domed inn like this, over 400 feet long and 160 wide, must once have been of much importance. Today it is an insignificant village, with a little khan where a few travelers stop on their way from the salt works of Lake Tatta to Konia, the ancient Iconium from which Paul, the Apostle, was driven out.

When we visited Sultan Khan there were not half a dozen people there beside the keeper of the inn and his servant. All the rest were scattered over the

RAMPARTS OF LIVING ROCK AT THE CASTLE OF PISHMISH KALESI, WITH THE MIDAS MONUMENT IN THE DISTANCE
(SEE PAGE 841)

plain at the 57 yailas, or summer hamlets, where they stay from April to October. There they feed their flocks, for it is only by scattering themselves over a broad area that sufficient grass can be found for all the animals which form the chief means of livelihood. The great flocks of sheep stay at the yailas all the year, cared for by a few lonely shepherds. The other animals—horses, cows, camels, and donkeys—are taken to the large villages in winter and fed on the hay stacked on the roofs. In summer, however, they, too, are taken to the yailas. This sort of nomadism prevails over large parts of the plain of the Axylon. Once the case was different.

ANCIENT ARCHITECTURE OF THE NOMADS

In the days of Midas and Crœsus, and in the times of the Greeks and Romans, nomadism appears to have been unknown in this part of the world. The chief proof of this lies in the large number of ruins, all of which, to judge from the style of architecture and the nature of the Greek inscriptions, were inhabited at about the beginning of the Christian era. During nine days' travel in the plain of the Axylon, I passed through 16 actual modern villages, as distinguished from yailas or summer camps. I made no special attempt to visit ruins, merely examining those which came in my way. Nevertheless I passed through the ruins of 42 genuine villages, not to mention various small isolated instances. Most of the 16 sites now occupied by modern villages were doubtless also occupied in the past.

It is certainly safe, then, to say that the number of ancient villages was at least 48, or three times as many as exist today. Probably all these villages were occupied at the same time, during the days of greatest prosperity, but, even if only half were occupied, the population must have been much greater than at present, for the old villages were almost universally larger than the modern ones. They must have been much richer, also, in order to erect the fine buildings whose carved columns are found in large numbers.

AN ANCIENT FLIGHT OF STEPS CUT FROM SOLID ROCK BEFORE THE MOSQUE OF SAVATRA

Take, for example, the village of Ak Viren, in the middle of the plain. The place has no running water, but depends upon deep wells. The inhabitants cultivate a considerable amount of land, but rely mainly upon their flocks for sustenance, because the crops are so poor and precarious. The present population numbers 130 families, whose houses are scattered irregularly among extensive ruins. Once the town was a fine place, the capital of the district. Savatra, as it was called, boasted some excellent buildings, in one of which was placed the flight of seven steps shown in the above photograph. They were carved from a solid block of limestone and are now preserved in the yard of the mosque. The old town occupied an area which I estimated to be ten times as large as that of the modern village. Other ruins are correspondingly larger than their modern representatives. In view of all the evidence, it seems con-

GENERAL VIEW OF THE TOMB OF MIDAS AND OF THE MODERN CIRCASSIAN VILLAGE AT ITS FOOT

servative to say that 2,000 years ago the population of the plain of Axylon must have been at least five times as great as now. With such a population, and with towns of such large size, a semi-nomadic life like that of the present day would be impossible.

The former prosperity of Asia Minor is admirably illustrated by the tombs, castles, and other monuments found among the Phrygian Mountains, west of the plain of Axylon. Here lies a pleasant region, wooded with fine pines which cover breezy ranges of hills and surround fertile valleys. Rain is more abundant than in the plain of the Axylon and the population is correspondingly denser and more prosperous. The inhabitants are of exactly the same race as those of the Axylon, and they profess the same religion and are subject to the same government, but their mode of life is different. Nomadism is unknown, for the good reason that it is not necessary, because as a rule the crops are good, and even in bad years there are no such complete failures as in the plain farther east. Nevertheless the Phrygian Mountains are not a rich region, and often the crops are so scanty that distress ensues, for here, too, the long summer is rainless.

THE FABLED WEALTH OF ASIA MINOR IN THE PAST

About 2,600 years ago Phrygia was the home of a dynasty of kings who went by the name of Midas. The fame of their wealth spread far westward to the Greeks on the coast of Asia Minor, and so to Greece itself. We do not know how rich they actually were, or how prosperous their country was, but we can judge somewhat from the ruins which they have left behind. The most famous is the so-called Tomb of Midas, a perpendicular surface of rock 55 feet high and 50 feet wide, covered with ornaments in a complicated rectangular pattern of crosses, meanders, squares, and other devices, surrounded by a long Phrygian inscription. Its appearance is shown in the illustrations. It is unknown whether it was the Midas mentioned in this inscription or some other of his dynasty whose wealth gave rise to the famous tradition, but it is evident that a people who could build such monuments must have been not only prosperous and wealthy, but somewhat highly civilized. Scores of other monuments and well-wrought tombs are scattered through the country.

Great castles were built to protect the towns, and the great "Royal Road" to Persia passed this way. So abundant was labor and so prodigal the kings that when a rampart was planned for the castle of Pishmish, facing the Midas tomb a mile or more to the east, the whole top of a huge isolated rock was cut away, forming a platform around the edge of which was left a wall of living rock. Today the site of the city of Midas is occupied by a village of poor but industrious Circassians, who bewail the fact that they were ever persuaded to leave their homes in the Caucasus for a region where they continually suffer from poverty.

THE CAUSES OF THE POVERTY OF TODAY

To go back now to the cause of the present poverty and nomadism of the plateau of Asia Minor. In the first place, the people of the Axylon and other regions are not nomads by choice, but by necessity. They regret that they cannot cultivate more land. The damp areas which aroused the scorn of the Greek wagoner are untilled for the good reason that they are so saline that crops will not grow. I examined the matter with care. In several cases I found rich men who have recently tried to use the streams for irrigation. In each case there has been a good growth the first year, but in the succeeding seasons rapid deterioration has set in. The little trees, which start out bravely, pine away and die; the vegetables, which grew vigorously the first year, are sickly the second, and fail utterly in later years. It is possible that modern methods might redeem the land, but no methods used in the East could do so.

Again, in the higher parts of the plain, where there is no trouble from salt, there

A FLAT-ROOFED ANATOLIAN VILLAGE

The village lies near the forested Phrygian mountains, and therefore employs an unusual amount of wood

GATHERING SALT IN THE VOLCANIC LAKE (SEE PAGE 835)

SUMMER HOUSES OF NOMADS IN THE AXYLON

WINTER VILLAGE OF NOMADS IN THE AXYLON

TENT OF A KURDISH CHIEF IN THE AXYLON

THE WOOD MARKET AT AFIUN-KARAHISSAR

BOUND FOR THE WEEKLY MARKET

WINNOWING THE WHEAT AFTER IT HAS BEEN THRESHED BY A SLEDGE DRAWN BY OXEN

is endless trouble from lack of moisture. If the inhabitants tried to rely upon agriculture they would either starve in a few years or be forced to abandon the country. Thus it appears that here, and also in almost all other parts of Turkey where nomadism is practiced, the people must either depend upon flocks, and wander from place to place, or must give up the country entirely. Therefore it is not the people who have nomadized the land, but the land which has nomadized the people.

In ancient days nomadism was not necessary, because then the climate was moister than now, so that the dry places were damp enough for crops and the saline places were in many cases kept fresh. The proof of this is abundant. It consists partly of the strands of old salt lakes which are proved to have stood at much higher levels in the past than in the present, showing that they received more water.

Another line of evidence is found in the location of old cities. Sir William Ramsay, the greatest authority on the geography of Asia Minor, says that in ancient days the chief towns were located where it was most convenient for trade or for defense. In modern days, however, the locations have often been changed, he says, to sites less convenient than those of the past, but which have the advantage of a larger water supply. That is, great towns could formerly be located almost anywhere, because everywhere there was enough water. Now, towns, even of smaller size, cannot be located except in places where there is an exceptional amount of water.

Another kind of evidence is found in towns like Ak Viren, already mentioned. Here the chief town of the region grew up in a place that is now not only too dry to support a large town, but absolutely devoid of anything to support a small town. Semi-nomads, like those of the Axylon plain, could never build a fine little city such as old Savatra. It could have grown up only at a time when the plain was so well watered that good crops could be grown everywhere.

Scores of other facts point to the same conclusion. The change is not due to the cutting off of forests, for it occurred over a vast area, including Arabia, Syria, Persia, and Turkestan, as well as Asia Minor, and in much of this region there is no evidence that forests ever existed during historic times. It has also occurred in places where forests once existed but are now gone, and in places where they have always existed and still survive. Hence it is a general change, affecting all of Asia from western China to Asia Minor, and probably a far larger area, extending eastward to the Pacific Ocean and westward to the Atlantic.

CLIMATIC CHANGES PAST AND PRESENT

The change from the conditions of the past to those of the present has not progressed uniformly. About 600 years after Christ there was a period of a century, more or less, when the climate was even drier than now. When the change took place from the previous moist conditions to the great aridity of the seventh century, hundreds of thousands and possibly millions of people in the drier parts of Asia began to suffer from lack of water for their crops and grass for their cattle. Their families were hungry and their children cried for bread. So the fathers cast about for new places to occupy, and began to move this way and that in great hordes, taking with them their wives, children, cattle, and household goods.

Thus, apparently, arose the great migrations which overwhelmed Europe in the Dark Ages. It was hunger, due to drought, which made the early Mohammedans so terrible a scourge. Hunger drove them and religious fanaticism united them. In the great changes of this turbulent time the last vestiges of the wealth of the land of Midas were swept away, for no land can be rich if its people suffer from hunger.

A TALK ABOUT PERSIA AND ITS WOMEN

By Ella C. Sykes

Author of "Through Persia on a Side-saddle," "Story-book of the Shah," "Persia and Its People"

With Photographs by H. R. Sykes

PERSIA is one of the oldest empires in existence. It has been a kingdom for 25 centuries—ever since Cyrus the Great, about 550 B. C., conquered Media and united that country to his under the name of Persia. It has had many glorious episodes in its long history; has produced the great teacher Zoroaster; such world-famous poets as Firdawsi, Omar Khayyam, Saadi, and Hafiz, and such great soldiers and rulers as Darius I, Shapur I, and Shah Abbas.

Again and again the empire has been a prey to anarchy; again and again conquering hosts have swept through the country, Alexander the Great having many a successor, the most destructive conqueror being Chinghiz Khan with his hordes of savage Mongols—a leader who boasted that he had slain thirteen millions of his fellow-creatures!

At the present day, though shorn of its former dimensions, Persia is more than three times the size of France, yet it has only nine and a half millions of inhabitants—15 to a square mile. As the population of the whole country is not equal to that of London, New York, and Paris combined, none will be astonished to learn that it is possible to travel for days at a time without coming across a village or even a human being.

The center of the country is a great plateau, rising from 2,000 to 6,000 feet, and crossed by frequent chains of mountains, while a lofty mountain barrier bounds it on the north and south.

The climate on this plateau is a fine one—dry and bracing, cold in winter and often intensely hot in summer. When living in the southeast, the writer's home was at a height of 5,600 feet, and in order to escape the summer heat she camped at an altitude of 11,000 feet among the running streams and bush herbage at the foot of a snow-capped range. The Lut or desert, once an inland sea, occupies the center of Persia, cutting off the north from the south and the east from the west, and thus rendering communication difficult. In fact, it helps to make transport so costly that the different districts and principal towns are practically isolated, and cannot depend upon other parts of the country, even in such a case as that of famine.

There are great differences of climate in the kingdom, the low-lying, feverish district round the Caspian, with its dense forests and 50 inches of rainfall, being in complete contrast to the arid uplands, where as a rule not a tree or a blade of grass is to be seen save on the irrigated ground round a village.

Again, on the shores of the Persian Gulf, the moist heat during summer is well-nigh intolerable to Europeans, and the groves of date-palms that constitute the wealth as well as the staple food of the inhabitants are only possible where there is irrigation, so rainless is this torrid region.

INADEQUATE TRANSPORTATION METHODS

In the whole Persian Empire there are only six miles of railway, and of roads only four, their total length amounting to under 800 miles. There is only one navigable river, the Karun, that flows into the head of the Persian Gulf, and on this sea the so-called ports are merely open roadsteads, at which cargo cannot be landed in stormy weather.

The merchandise of Persia is practically carried on the backs of camels, mules, and donkeys, a slow and expensive mode of transport, and the traveler usually rides through the country follow-

A CARAVANSERAI; THE PERSIAN HOTEL

A COOK-SHOP

PERSIAN BOYS

THE SHOP OF A VILLAGE BUTCHER

DERVISHES

ing the tracks made by the passage of caravans during the centuries.

It will be understood from what has gone before that hotels must be bad, if not non-existent, and indeed the ordinary caravanserai, swarming with vermin, with only openings in its walls in place of doors and windows, with no furniture of any description, and hardly any food, would appall any one unaccustomed to Eastern travel.

The Persian is of Aryan stock, and has the same words as ourselves for father, mother, brother, and daughter (*pidar, madar, bradar,* and *dukhtar*), and the construction of his language is like that of English.

He is a handsome, well-built man, with regular features and fine black eyes, his complexion being no darker than that of an Italian. In manner he is most courteous; he is quick, alert, fond of conversation and discussion, and has been rightly called the Frenchman of the East.

Persia has been a Mohammedan country from the time of its conquest by the Arabs, in 641; but some thousands of Zoroastrians, the old fire-worshipers, still remain in the land, and have been much persecuted.

PERSIAN MUSICIANS

THE AUTOCRAT OF THE HOUSEHOLD

In order to understand Persian domestic life at the present day, we must carry ourselves back to patriarchal times. The Persian is lord and master of his house much as was Abraham or Jacob. He has enormous power over the persons of his wives, children, and dependants, all of whom he can treat much as he pleases.

When a woman is handed over to her husband with her dowry, he regards her far more as a chattel than as a wife. She may never show her face to any man save her husband and near relatives, and, owing to the extreme seclusion in which she lives, it is most difficult for her to get justice should she be ill-treated. There are certain laws for her benefit in such cases as that of divorce, but these are only enforced when a man divorces his wife.

If the case be reversed and the woman carries her slipper to the judge and demands separation from her husband, the latter is not obliged to refund the dowry that he received with her.

Brutal husbands who wish to be rid of their wives and yet retain their dowry sometimes ill-use them in order to force them to sue for a divorce themselves.

If a man is angered with his wife and says three times, "I divorce you!" he has legally severed himself from her, and, should he desire to have her back again, she will be obliged to marry and then be divorced by another man.

The happiness and position of a Persian woman usually depends upon her children. Her great wish is to present her lord with sons. "He that has no son has no light in his eyes" is a well-known saying, and a man feels that he is disgraced if he has no heir to carry on his

A FIRE-WORSHIPING FAMILY: TEHERAN

Photo by M. Sevraguine

name. When a child is about to come into the world two cradles and two little suits of clothing are in readiness. If a boy make his appearance he is placed in a silken bed and clad in beautifully embroidered garments; but if a girl should arrive to her falls the cotton cradle and the common attire. Her nurse goes in fear and trembling to break the news to the father, who may, in his anger, order the luckless woman to be bastinadoed instead of giving her the gift that would have been her due had she announced the birth of a son. From the moment of his entrance into the world, throughout his entire life and even in the hereafter, the Persian man has decidedly the best of everything and the woman the worst.

WILD SHEEP SHOT BY MR SYKES

MOULDING THE CHARACTER OF THE YOUTH

The man of well-to-do parents receives his education from a *mulla,* or priest, who teaches him to read and write, and to recite the Koran in Arabic, probably without understanding a word of the Mohammedan bible. At about eight years of age he is more or less separated from the women, and now practically lives with his father and with the latter's men friends, being in the charge of servants who teach him to ride and to shoot.

His dress is that of his father's in miniature — the brimless astrakhan hat, the European trousers, the frock coat much kilted at the waist, the vest of Kerman shawl, and often the elastic-sided boots. He will accompany his father when visiting, and soon learns the elaborate code of Persian etiquette, being careful to address royalties, officials, church dignitaries, merchants, and so on by their proper titles, and deal out to each the right amount of courtly phrase. He will be told to speak of himself as the *baudeh* or slave of any superior, but will be warned that it is considered sarcasm if he gives to any man more compliment than is his due.

The "strenuous life" finds no favor in Persia, the ideal of a young Persian being to act as a hanger-on at court, or to be included in the suite of some governor of a province or high official, such sinecures being spoken of as "doing service".

The Persian, however, is a fearless rider and a keen sportsman. He loves to gallop his horse at its fullest speed, digging the points of his shovel-shaped stirrups into its ribs to urge it to yet greater efforts; and then he will pull it up suddenly with the severe Persian bit. Or he will take part in a gazelle hunt, making one of a large circle of horsemen, who gradually hem in a small herd of these shy animals, drawing closer and closer until the terrified *ahu* attempt to break through the ring. Then the sportsmen fire at their quarry, Persians being so reckless in moments of excitement that sometimes the riders get shot instead of the game.

To climb the mountains after the ibex and wild sheep is the hardest form of sport, and hawking and partridge shooting are also favorite amusements. Nothing, however, comes amiss to the gun of a Persian, who will bring down a crow or any small "cockyolly" bird if no better game is to hand.

The well-to-do Persian is roused before sunrise by the call of the *muezzin* summoning all men to prayer. He throws aside the padded quilts that form his bed, hastily dons his garments, and exchanges the felt skull-cap in which he

A STREET IN A PERSIAN TOWN

A CAMEL BOY

SCENES IN A PERSIAN BAZAAR

Photos by M. Bourke

CUTTING UP A CAMEL FOR FOOD

OXEN PLOUGHING

sleeps for the black lamb's-wool hat. His servant then pours water over his hands, and he washes his face, arms, and feet before prostrating himself on his prayer-carpet, which is turned in the direction of Mecca.

After his devotions (which he repeats at noon and at sunset) are accomplished, he partakes again of much-sweetened tea without milk, and with it eats a thin cake of flabby bread and some sweetmeats. Then he smokes a *kalian,* or water-pipe, and feels fortified for the work of the day, whatever it may be.

At noon an ample repast is served on a leather cloth laid on the ground, and the standing dish will be *pilau,* which consists of a mound of beautifully cooked rice mixed with chopped meat and vegetables.

All Persians sit on their heels, and they eat with their fingers, manipulating the *pilau* most cleverly with the right hand, it being a mark of ill-breeding to use both hands when feeding.

The meal is discussed in total silence, and, when all the greasy right hands have been washed with rose water, the party betake themselves to slumber, a midday siesta being indulged in from the highest to the lowest.

Tea, fruit, and sweetmeats are partaken of during the visits which Persians are so fond of making, and often the evening meal is not served until 9 o'clock, all going to rest immediately they have finished eating.

According to the Mohammedan religion Persians are not permitted to indulge in alcohol, and the strict confine themselves to sherbets (fruit syrups). But the wines of Shiraz, Hamadan, and Isfahan, or arrack, the spirit made from grape refuse, prove too strong a temptation to many, and unfortunately the Persian only drinks in order that he may become inebriated.

PRE-MATRIMONIAL ARRANGEMENTS

Friday, the Mohammedan equivalent to the Christian Sunday, is the day when business is suspended in the bazaars, and the faithful resort first to the public baths, and, after their ablutions, to the mosque. Here all prostrate themselves in the direction of the kaaba, the sacred black stone built into the mosque at Mecca, and their devotions are led by a priest, the proceedings terminating with a discourse called the *khutbah.*

When a Persian reaches manhood his parents busy themselves in arranging a suitable marriage for him. As he has never looked upon the face of any lady, unless she be a near relative, he has absolutely no choice in the matter. His mother selects his *fiancée* and he is not supposed to meet her until the public betrothal by a priest takes place.

If he then dislikes what he sees of a face that is almost disguised with rouge and powder, he can draw back, but he has to hand over to the girl's parents half the value of the dowry that he would have received with her, and, moreover, he is socially disgraced.

Marriage is, however, by no means such a serious matter as it is in some countries. The Prophet permits his followers to have four wives apiece and as many temporary connections as they please, and we have already explained how easy it is for a man to rid himself of an uncongenial helpmate.

DOMESTIC LIFE AND CUSTOMS

Moreover, many Persians have no home life in the usual sense of the word. A Persian house is divided into the *birooni,* or men's apartments, and the *anderoon,* or part consecrated to the women. A strong door, set in a high blank wall, gives entrance to a narrow passage that leads into a square courtyard on which open several rooms. Here the men live, and here they usually feed and entertain their friends, while their women dwell in rooms set round an inner courtyard, the only entrance to which is through the *birooni.*

As a Persian is instructed from earliest youth that a woman's advice is of no account—in fact, the priests tell him that he had better do the exact opposite of what a woman counsels—it can be understood that as a rule he has no exalted

opinion of his wife or wives, and seldom turns to them for companionship.

When death approaches, if he has performed his daily prayers, kept the Fast of Ramazan, visited the mosque on Friday, and given alms to the poor, a Persian has no doubts as to his reception in the next world and dies in a happy confidence of attaining to the paradise promised by the Prophet to all his faithful followers.

Rivers of delicious water, milk, and honey flow through beautiful gardens planted with shady trees. These latter thrust their branches laden with luscious foods into the mansions where the faithful, arrayed in silk, lie on couches and are tended by houris of surpassing loveliness.

Seventy-two of these angelic beings fall to the lot of the humblest believer, and they sing enchantingly to him, fulfill his least desire, and make him forget the women he has known on earth.

THE RESTRICTED OPPORTUNITY OF PERSIAN WOMEN

And now I will ask the reader to turn to the life of the Persian woman and contrast it with that of her lord and master.

Often she comes into the world unwanted and meets with no welcome, and through life she is usually neglected and made of little account. Sometimes she is educated with her brothers up to the age of eight, but after that she is separated more or less from them and is relegated to the *anderoon*.

In Persia it is rare to find a woman who reads or writes, and a girl will employ her time in embroidery, in making sweetmeats and sherbets, and in much gossip with her women friends and servants.

Her indoor dress in summer is a gauze jacket, and very full, short trousers that do not reach to the knee, this latter garment being introduced by Nasr-ed-Din Shah, who was greatly fascinated with the costume of the Paris ballet girls.

A Persian lady cuts her hair in a straight fringe across the forehead and mixes her tresses, if not abundant, with horse-hair; but she always covers her head with the *chargat,* a handkerchief of fine muslin that she wears by day and night, and which it would be the height of impropriety to remove.

In appearance she has fine eyes and good features, small hands and feet, and a figure usually too stout for European taste, while, owing to her secluded life, she often looks dull and unintelligent. Her fondness for cosmetics leads her to rouge and powder her face most inartistically, and she uses *kohl* to impart a languishing look to her eyes and to double the width of her eyebrows, making them sometimes meet at the bridge of her nose.

When a woman wishes to leave the *anderoon* her dress is a complete disguise. She draws up to her waist a garment, socks and trousers in one, and over this she drapes the *chadar,* a large black wrap covering her from head to foot. Hiding her features is a white silk or cotton cloth with just a strip of lace-work across the eyes, and death would be the penalty were a man rash enough to raise that face-cloth. Heelless, flapping slippers complete a costume which is almost suffocating in the summer heat, and which at any time makes its wearer look like a waddling bundle.

The public bath is the Persian woman's chief dissipation. Here she meets her friends and spends many hours in the hot, steamy atmosphere, while her servants dye her hair with henna and indigo and tint her nails and the tips of her fingers and toes with the scarlet juice of the former plant.

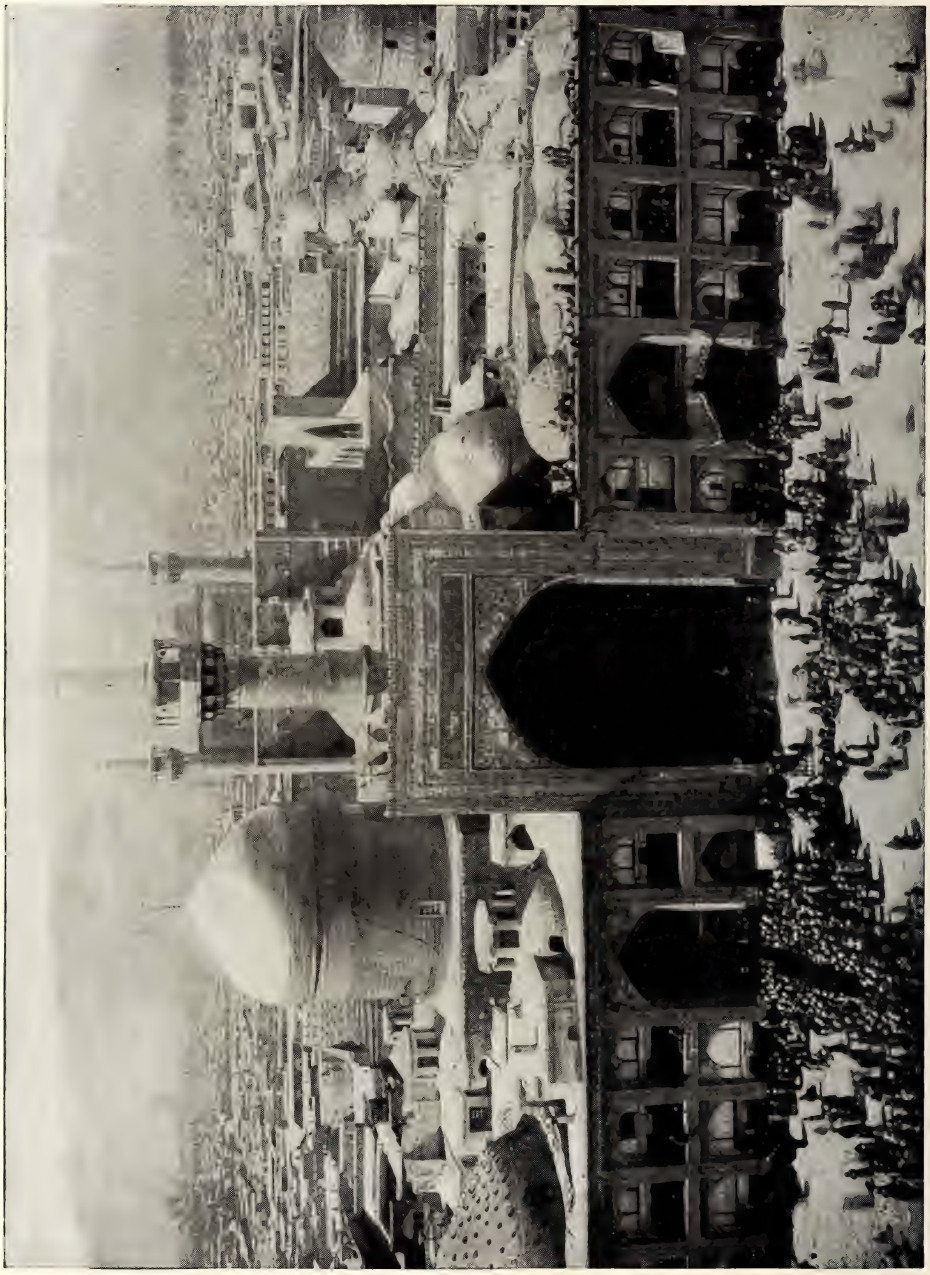
Perhaps she will go to the mosque on Friday, but if she does so she will be confined in a closely latticed enclosure from which she can see and hear but little of the proceedings.

HER FATE DECIDED BY OTHERS

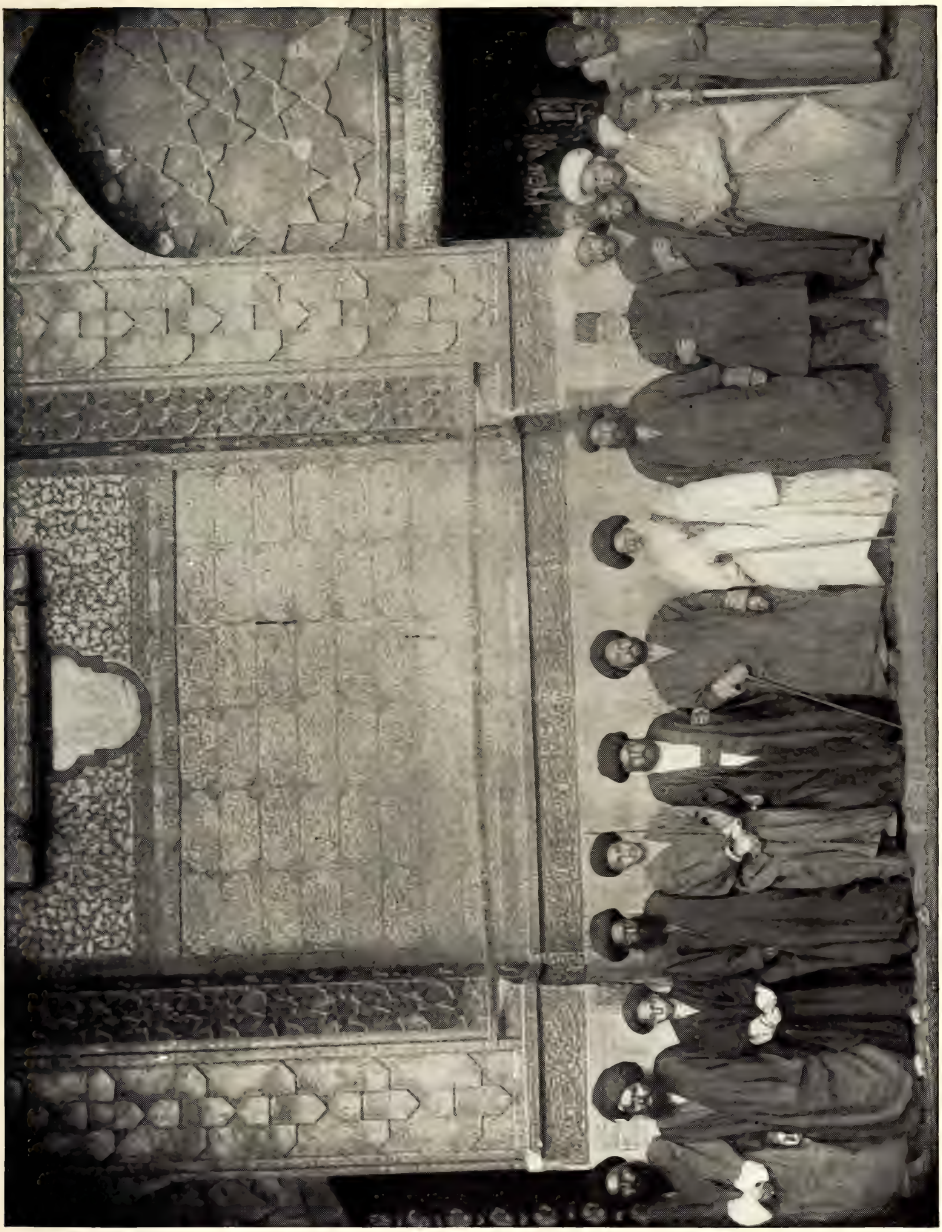
Of course marriage is the great crisis in a girl's life, but in this, as in everything else, she has no choice. Her parents often have no idea of consulting the tastes of their daughter, and girls are

ENTRANCE TO A PERSIAN VILLAGE

A PERSIAN PEASANT FAMILY



THE SHRINE OF THE IMAM REZA AT MESHED



GOVERNOR AND THE OFFICERS OF THE SHRINE "IMAM REZA"

A ZOROASTRIAN OR FIRE-WORSHIPER

MESHED: THE SHRINE AND MOSQUE

sometimes handed over to men old enough to be their fathers or even grandfathers; there is also much marriage among cousins in order to keep the property of a family together.

Once married, the young wife's strongest wish is to become the mother of a son, for she knows that her husband's affection, and, in fact, her entire position, depends on this. If no son is born to a man he will take to himself a second wife, or perhaps divorce the first, and it may easily be imagined what jealousy and heart-burning are roused if there are rival wives in the same establishment.

In any case a wife cannot be a real companion to her husband. It is not etiquette for him to be seen with her in public; he may not salute her should he recognize her in the street; her secluded life prevents her from knowing what is going on in the world, and she is not acquainted with any of his friends, nor can he meet any of hers. Consequently he spends his days apart from her and usually eats with his men friends, the women of the household finishing what he may leave.

A woman's great consolation lies in her children, there being much filial piety in Persia, though the son's love for his mother has apparently no influence on his behavior toward his wife.

TERRORS OF THE HEREAFTER

When a woman becomes old her thoughts turn often to the other world, and she makes up her mind to go on a pilgrimage. The Prophet, it is related, when permitted a glance into hell, found that the great majority of the victims writhing in torment were women. As lions with 7,000 teeth and vipers with 7,000 fangs mingle with fiends, all working away with a will to torture the luckless inmates of the infernal regions, most women would count no effort too great to escape from such a doom. Only by a life of unremitting virtue can they attain to a paradise into which apparently any man may enter with comparative ease.

A woman knows, however, that a pilgrimage to Mecca, Kerbela, or Meshed will save her from the terrible Mohammedan hell, and she cajoles what money she can from her husband, sells her jewels, and starts off with a party of friends and servants. Meshed, being in her own country, is probably the goal of her journey, and what a journey it is for a woman well advanced in years and unaccustomed to exertion! If she cannot afford the swaying *takht-i-ravan,* or litter, she must sit cramped up in a *kajaveh,* or pannier, strapped on one side of a mule, or else ride astride on a rough pack-saddle. However hot may be the weather, she must keep her face covered up and her figure shrouded in the all-enveloping black cloak.

At sunset she will arrive at some caravanserai; her servant will sweep out a recess for her, will hang a carpet before the opening, and spread out her *resais,* or cotton quilts, and all night long she will hear the noise of mules and the talk of the muleteers, and will probably be troubled by the insect life which is very active in these rest-houses.

Day after day her mule jolts her over great plains destitute of a single tree and with only veitch or camel thorn sprinkled on the gravelly soil. She will cross the ranges by passes that lead into other plains, the replica of those which she has traversed; her food will probably be insufficient, and she will be forced to drink water often brackish and sometimes absolutely foul, for she has no filter with which to purify it.

At last, coming to the crest of a hill, she sees the glint of a gilded dome and knows that the goal of her journey, the sacred shrine of the Imam Reza, is not far off, and that from henceforth she will bear the proud title of *Meshedi.* She and all the other pilgrims dismount and prostrate themselves in adoration, and before sunset the party is entering Meshed by a gateway badly in need of repair and our lady's servant has got quarters for his mistress in a house as near the shrine as may be.

The next day she will betake herself to the shrine, where she will be met by a band of *Seyids* (descendants of the

GATEWAY OF A PERSIAN CITY

A VILLAGE PASSION PLAY: NOTE THE WOMEN WATCHERS ON THE WALL

Prophet), one of whom will recite to her the proper Arabic prayers, which she must repeat after him, and he will tell her where to make her genuflexions. She will gaze in amazement at the jewels, the magnificent carpets, and the weapons hung on the walls of the shrine, and she will join the band of pilgrims who pass round the silver trellis-work that encloses the body of the Imam Reza, kissing with fervor the silver padlocks of the gates.

She will also visit the beautiful mosque close by, and will pay a priest to read portions of the Koran to her daily, as it is improbable that she can peruse the Mohammedan bible herself. In the screened-off portion of the mosque, set apart for women, she will meet the friends from her native city, and will spend much of her time in conversing with them. A whole year may elapse before she makes up her mind to return to her husband and family, and indeed she is not greatly needed at home. Her children, if they are young, are in the charge of a faithful slave, and, as her husband has always engaged the servants, and has disbursed all money required for the household and has overlooked the accounts, she is hardly wanted at all.

EARLY PREPARATIONS FOR THE END

Day after day, in approaching the shrine, she walks over a pavement composed of countless flat tombstones, and she sometimes wonders whether she may not have the good fortune to die in the holy city, in which case her bones would be laid to rest in this great cemetery and she would go straight to paradise. Persians pay from $50 to $500 for a grave near the shrine. But they do not remain in possession of it very long. Directly the inscription cut on the stone is worn down by the feet of the myriads of pilgrims, the corpse is dug up and its place is taken by a new occupant with a new stone, or even the old one recut!

If the Persian lady, however, makes her way home, she will die in the odor of sanctity and with the coveted title of pilgrimage, and her body may form one of that terrible caravan of corpses returning to the shrine to be buried that the traveler sometimes meets in the neighborhood of Meshed or of Koom.

When she dies the hired mourners arrive to weep and lament; all water in the house is thrown away lest the inmates be afflicted with colic; a priest recites the Koran, and the corpse is placed in the coffin with a stick under each armpit. This is for the purpose of enabling the deceased woman to raise herself when the blue-eyed angels come to question her as to her orthodoxy. If she can answer to their satisfaction her coffin will expand to the size of a room, but if they are not pleased with her, her last resting-place will close in upon her, all animals being able to hear her shrieks of agony as she is thus tormented. Even if all go well, she has to pass the Bridge of Sirat, "finer than a hair and sharper than a sword," which spans the fires of hell, and only a minority of women can tread this in safety and enter into the regions of the blessed. Here apparently the Prophet did not contemplate that husbands and wives should meet one another again, and we find that the women are relegated to a paradise of their own with angel attendants. In fact, this glimpse of the life of a Persian woman assuredly bears out my contention that she has the worst of it in every way, from the moment of her birth even to her life in the world beyond the grave.

THE POSITION OF THE SLAVE

I have said that Persian domestic life was really patriarchal, and I cannot leave this subject without mention of the servants and slaves who form so important a part of a Persian household. The former are treated as members of the family; their master calls them *batchaha* (children); he feeds and clothes them, and, if displeased with them, orders them to be bastinadoed. They are supposed to be paid their wages in cash, but, as ready money is usually scarce in Persia, their master often rewards them in a somewhat ingenious manner. He will employ them to carry a gift to some

superior, who must give the bearers the value of the offering in coin of the realm. Europeans, on their arrival in the country, are often victimized in this way. A dish of apples, a melon, or perhaps a few limes will be presented to a *feringhi* (foreigner) with great ceremony, the worthless present placed on a beautifully chased metal tray covered with a magnificently embroidered cloth!

The servants purchase everything needed for the household in the bazaars, an honest domestic taking a 10 per cent commission on all he buys, and they collect the gossip of the town with which to amuse their masters. Servants burst into the conversation of their betters at any moment, and, though in some ways they may like the service of a European, with its fixed money wage, yet they constantly feel "left out of it" as they hear the unknown language of their employers.

Curiously enough, the slave has in many ways a most enviable position in Persia. He has cost much money; therefore he is given the best of food and clothing and is never forced to do hard work. Having no family of his own, he is supposed to center all his interests in that of his master, and the latter will often leave him in charge of his children and his valuables. A slave frequently amasses a fortune if he is in the service of a highly placed official, for all visitors will bribe him in order that he may curry favor for them with his master; but he seldom wishes to purchase his freedom.

SUPERSTITION A FUNDAMENTAL CHARACTERISTIC

From this article it will be judged that Persia is neither an enlightened nor progressive country; but only those who have lived there can understand the state of superstition in which the people live. Soothsayers and dervishes are consulted on every occasion, no business or journey being undertaken, no doctor summoned, or even medicine drunk unless the omens are ascertained to be propitious.

Ghouls, demons, *jinns,* and *afrits* haunt all ruins and lonely places. The former disagreeable visitants are so active at night that no Persian will sleep alone, and many a well-to-do man hires a priest to share his room and keep off these powers of darkness. The *jinn* is usually invisible, and on account of this no one would dare to fling hot water away with a splash or even throw stones, lest a *jinn* lurking near should be injured and wreak vengeance on its unconscious aggressors.

From the highest to the lowest there is a firm belief in the "evil eye". A prosperous Persian woman will dress her baby boy on his rare outings in common clothing, because, if some passer-by, attracted by fine attire, were to admire the child's beauty without adding the saving expression *Mashallah* (God is great), illness or accident would be sure to follow.

Blue is the color to avert the "evil eye", and all who can afford it wear a turquoise, the poor and animals being obliged to put up with blue glass beads.

Medicine must also be classed among the category of superstitions. A man in a burning fever will be laid in the ice-cold water of the channel that flows through the garden, because he is suffering from hell fire; the *jinns* are supposed to be beating a man in a fit of epilepsy; ground-up rubies and pearls are given to the rich as powerful tonics, and powdered glass is actually used to allay the inflammation in sore eyes! Witchcraft is suspected to be the cause of many an ailment, and there are countless recipes for foiling the exponents of the black art.

But in the limits of a short article it is difficult to do more than give a mere glance at Persia and its people. The writer, however, hopes that what she has written may interest people in a country that has had such a long and often glorious history and that is even now engaged in the difficult experiment of changing an old-world autocracy into a constitutional government.

Khoda hafiz-i-shuma—Good-bye.

THE GREATNESS OF LITTLE PORTUGAL

By Oswald Crawfurd

The early navigators of this youngest of republics discovered Brazil and both of the ocean routes to the Indies—via Cape of Good Hope and Magellan Strait. Her present population is about that of New York City, and her size corresponds to Maine or Indiana. According to statistics, her people have the longest heads in Europe and are also the smallest in stature. Three-fourths of the population above six years of age can neither read nor write, notwithstanding a law passed in 1844 making primary education compulsory. The following article is abstracted from "The Contemporary Review" of Edinburgh.

TRAVELERS leaving the unquiet waters of the Bay of Biscay behind them and getting their first sight of the peninsular mountains on the steamer's port bow must often have asked themselves, How has it come to be that, in this huge Iberian peninsula, one little slice of territory facing the western sea has remained independent throughout the ages, when so many other and seemingly more powerful principalities have tottered and gone to the ground?

Is the country too mountainous and inaccessible to permit invasion and conquest, like Wales or our British highlands? Or is there some peculiar virtue or quality in the inhabitants of this corner of the land that has served to keep it free and untainted by the foot of the conqueror? Or, again, has some one great man stood forth in the hour of his country's need, repelled the invader, and left lasting traditions of freedom and independence, never afterwards to be forgotten?

Nearly all these questions can be answered in the affirmative, and Portugal owes her existence to this day as a nation, not to any one of the circumstances here suggested, but to all of them conjointly.

The territory of Portugal is in point of fact a huge fortress whose enceinte is constituted by ranges of mountains in the north and in the east, and by the sea on its western and southern frontiers; but no fortress is safe from attack and capture unless the garrison is adequate, and the Portuguese have shown themselves at all times of their history, from the first forlorn hope of their uprising, under Sertorius, against the Romans, a people apt for freedom and strong and stout in opposing foreign domination.

The country is indeed hard of access, but not inaccessible, as has been proved in every age of its history, and, compared to almost any part of Spain, its fertility, the amenity of its climate, and the richness of its soil have invited invasion. There is nothing in Portugal resembling the vast, arid, sunburnt, central tableland which constitutes nine-tenths of the neighboring country. The whole kingdom, sloping from the frontier mountains to the sea, forms a succession of fertile valleys interspersed with rich alluvial plains, watered by innumerable rivers, streams, brooks, rivulets, and water-springs; the air, tempered by breezes from the sea and mountains, and made agreeable by wood and stream, is far more genial than that of the great Spanish tableland. It is a region that has been coveted by the dwellers on the barren Iberian uplands in an age when agricultural wealth was nearly the only wealth.

In the early days of savagedom this region was eagerly colonized by Rome, and, later on, seized and settled on by Gothic tribes from the north, and, after that, appropriated by the Mahometan Moors. It was against these latter, and against the several nations of Spain that were beginning to rise to power against the yoke of Islam, that the first effectual struggle for freedom was made by the

inhabitants of Portugal—a struggle that ended in the constitution of the nation which is now modern Portugal.

THE LIBERATOR OF PORTUGAL

It might have seemed at first a hopeless struggle against overwhelming and impossible odds, and that the issue of independence could only be reached by a miracle. When seeming miracles come to pass in human affairs they generally happen by the action of some heroic personage who is also a man of genius. So it was with Portugal, and her hero, a greater one by far than the nearly contemporary Cid, El Campeador, in Spain, was the conqueror Affonzo Henriquez. The deeds of this Portuguese warrior king are authentically recorded in the dry chronicles of three nationalities, and in geographical and historic events whose effects and consequences subsist to our day. The actions of the Spanish champion, a condottiere captain who fought for his own hand mainly, now with, now against the infidels, were internationally as fruitless as the victories in the Trojan war. They have left no trace in history; they are suspected, indeed, to be partly mythical; but the memory of them lives, and will live always, for they are recorded in one of the great epics of the world.

Portugal has had two great epochs during which the doings of its people were of international importance and have left their mark enduringly on the history of the world. The first, the long fight for freedom under King Affonzo Henriquez, nearly synchronized with the second and unsuccessful crusade and was indeed itself a crusade, for the Portuguese king and his people were fighting the battle of Christian Europe for the Cross as strenuously and as effectively, in Lusitania, as Godfrey de Bouillon and Richard Cœur de Lion fought for it in Syria. The news had come to northern Europe that a champion of the Faith was holding his own against the Crescent in Portugal, and when the king resolved to attack and besiege the central Moorish stronghold at Lisbon, he obtained the help of a large body of crusaders from North Germany and the low countries, who sailed for the East from the mouths of the Rhine and put in at Dartmouth.

The Cross prevailed in the end and Islam fell, and with it the Moslem power in Portugal. The conqueror spared the citizens of Lisbon. The religious fanaticism and intolerance that have marked later periods of Iberian history were then unknown, and the great Moorish city continued its prosperous existence under equal laws imposed by its Christian conqueror. Evidence of the humane tolerance of the Portuguese is clear to this day to any one who passes from any northern city of the kingdom to Lisbon. The type of the Lisbon crowds is still that of the dark Moorish race who dwell in Tangiers and Fez.

Affonzo Henriquez, king, patriot, conqueror, and legislator, the real maker of Portugal, was succeeded during the first century of Portuguese history by monarchs who followed in his footsteps and maintained his great traditions. This is the first and most glorious period in the history of Portugal, but there has been a second memorable epoch in which Portugal has stood forth prominent among the nations and done more than her share to advance the civilization of the world.

HER INTREPID EXPLORERS

This second great epoch was inaugurated by Prince Henry the Navigator, at Sagres, at the extreme southern end of Portugal. Prince Henry built an astronomical observatory, studied the then almost unknown art and science of navigation, and despatched exploring expeditions at his own cost into the unknown ocean to the south and to the west. He discovered Madeira and the Azores and explored the eastern coast of Africa as far south as Cape Boiador, in the tropics Prince Henry's fame presently drew to Sagres, as to a college of the science of navigation, the sons of Portuguese nobles, who caught from him that spirit of maritime enterprise which during the succeeding centuries made Portugal one of the great colonizing nations of the world. The rare and difficult art of

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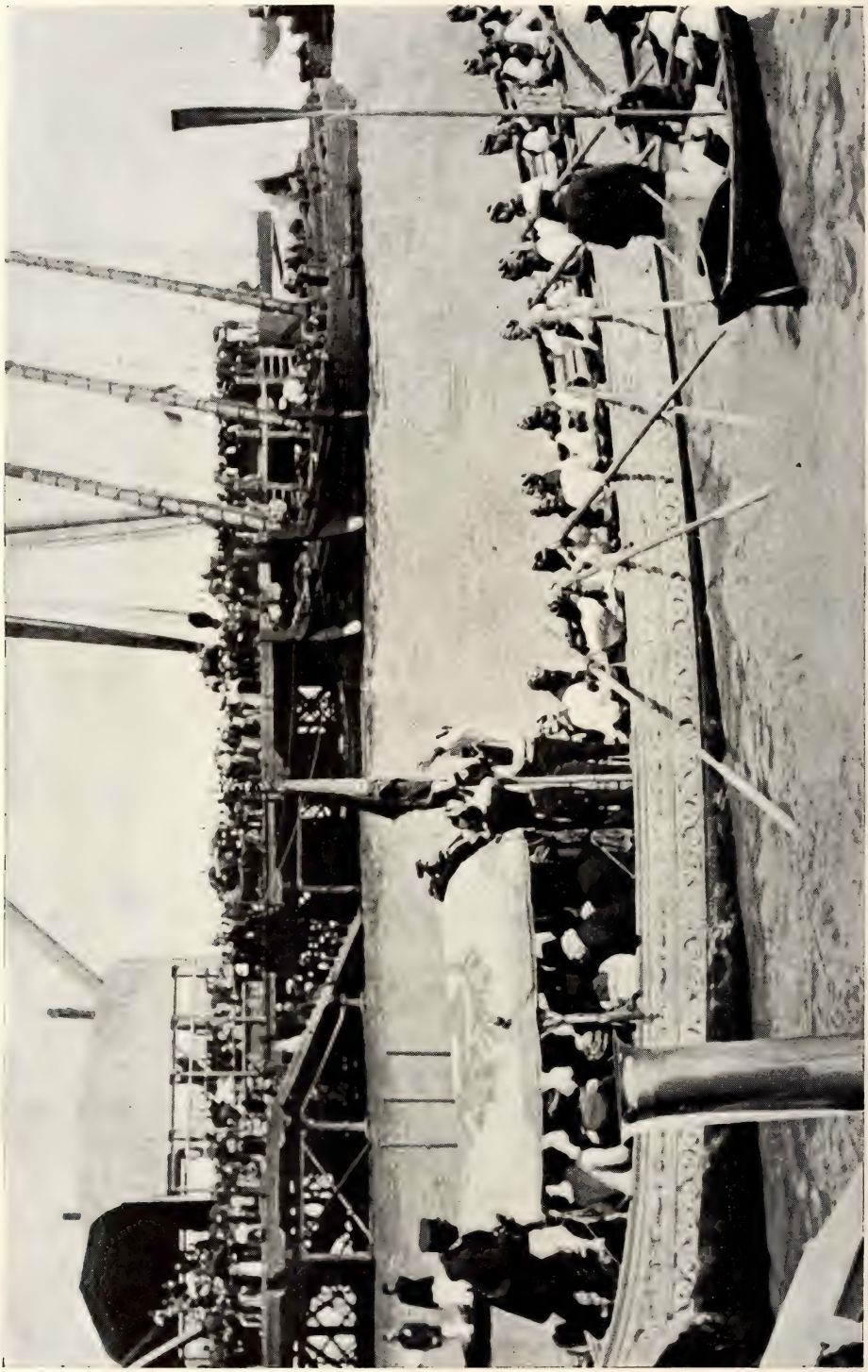
PRADA DE DOM AFFONZO HENRIQUEZ (SEE PAGE 868) AND STOCK EXCHANGE: OPORTO

Generally a foreigner speaking Spanish will be understood in Portugal; but a knowledge of Spanish, though enabling him to read Portuguese without difficulty, will not aid him much in understanding it when spoken, as the pronunciation of the two languages is radically different, The roads are usually very good, and open carriages with one or two horses can be hired in any town at an extremely reasonable price, $2.00 or $3.00 a day being ample for a carriage and two horses, which for the price will cover some five-and-twenty miles or more. The trains on Portuguese railways run primarily to convey goods and merchandise, and passengers must be content to wait while the goods are being loaded or discharged. The absence of vociferation in Portugal, which in a general way is a boon, is somewhat a drawback in railway traveling, as the names of the stations are not called out, and, as they are often painted inconspicuously, and are not visible from the carriage windows, it is necessary for strangers to be on the alert in order not to pass their station.—MARTIN HUME.



THE ROYAL BARGE AT LISBON

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THE FISHING FLEET ON THE TAGUS: LISBON

THE MONASTERY AT ALCOBACA

Built by Affonzo Henriquez, the liberator, to commemorate the Portuguese defeats of the Moors. The buildings are now used as barracks. The most striking objects in the Chapel of Tombs are two magnificent sarcophagi in florid decorated Gothic. The recumbent figures of king and queen upon them, as fair and perfect as the day they were sculptured, rest, not hand in hand as upon most similar tombs, but foot to foot. These are the sepulchers of Pedro the Just and Ines de Castro, for the faithful king ordered the body of himself and his beloved to be laid thus, so that when the universal trumpet should call him to arise, the first object upon which his reopened eyes should rest would be her, who, though unwed, was yet his wife through all eternity (see page 889).

colonization was not learnt in a day by Portugal, but it has never been forgotten. Other and wealthier nations have lost most of their oversea holdings, or keep them still with a rule so rigorous that it means servitude. The colonial kingdom of Portugal, under a wiser and more tolerant policy, has endured, not intact, indeed, but still a valuable and extensive kingdom beyond the seas.

The splendid example then set by Prince Henry the Navigator was followed by the Portuguese explorers and adventurers for nearly two centuries, and led to achievements and conquests of which the whole world is aware. It led to the great discoveries of Vasco da Gama, Pedro Cabral (the discoverer of Brazil), Amerigo Vespucci, and Magalhaes (Magellan) in the East and West Indies respectively, and to the conquests and tenure of part of India by Albuquerque; but these great triumphs must not diminish the fame of the man who first, in an age of comparative darkness, ignorance, and superstition, braved the terrors which the unknown seas then held for learned and simple alike.

Will this small nation ever again play a predominant part in the history of the world? In the modern race of the nations for wealth Portugal has established no record. It is still a small and agricultural nation, striving after industrial wealth which it has never attained and will never attain. It contains, however, in its most prosperous regions—the district lying immediately north and south of the River Douro—an object lesson in the prosperity of its yeoman farmers. This is a region where, by a slow struggle of the farmer against all the forces above him — feudal, ecclesiastic, and governmental—the small farmer has gradually won to independence and prosperity as a holder of the land. It would take more pages than this whole number contains to tell the full story of this struggle for existence and freedom which has ended in constituting a body of small yeoman farmers, their country's real strength, the like of whom is hardly to be found elsewhere.

A LAND OF YEOMEN

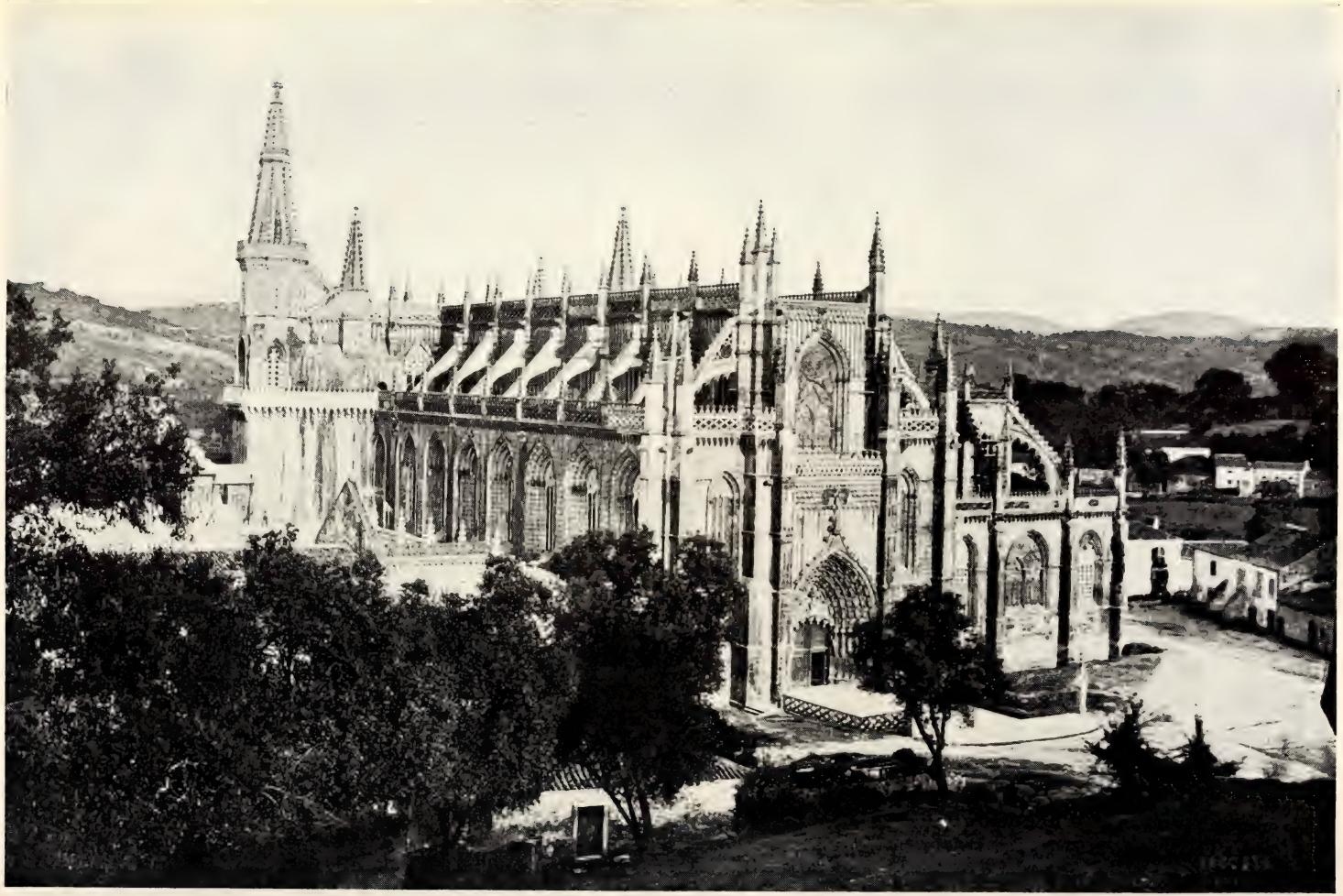
It was mainly from among this yeomanry that the regiments were recruited who fought side by side with our troops in the Peninsular War, whose hardiness and whose good pluck were the admiration of our men and officers, and of whom Wellington himself said that they were "the fighting cocks of the Peninsula."

The popular idea of Portugal, in my own experience, is that it is a sort of second-class Spain, the people lazy and idle, the language ugly and difficult, the literature poor. This report, absolutely and demonstrably false as it is, would be corroborated by most Spaniards. Neighbor nations seldom love each other. They seldom understand each other, and Spaniards and Portuguese are no exception. This attitude toward each other has been likened to that of two men sitting back to back on a bench who will neither turn nor speak to each other.

It is of course an error to consider either Spaniards or Portuguese as a single race. Galicians, Asturians, Aragonese, Castilians, and Andalusians differ among themselves as much as the man of northern Portugal from the dweller south of the Tagus. The difference in both countries is often as marked as that between Germans and Italians.

Portugal has been less written about than perhaps any country of its size and importance in Europe. The difficult Portuguese language has been a bar to the traveler and travel-writer.

Portugal is nearly the same now as it was ten, twenty, perhaps fifty years ago. It is an agricultural country, and in its most prosperous provinces it is a land of small proprietors, farmed by the holders themselves. I speak chiefly of the region north of the Tagus. On a 20-acre farm there can be no room for improved agricultural machinery, or for steam plows, reapers, or threshers. The land is mainly hilly, the fields are tiny and often built up into terraces by supporting walls, and their surface broken by the leaders and water channels that, in the

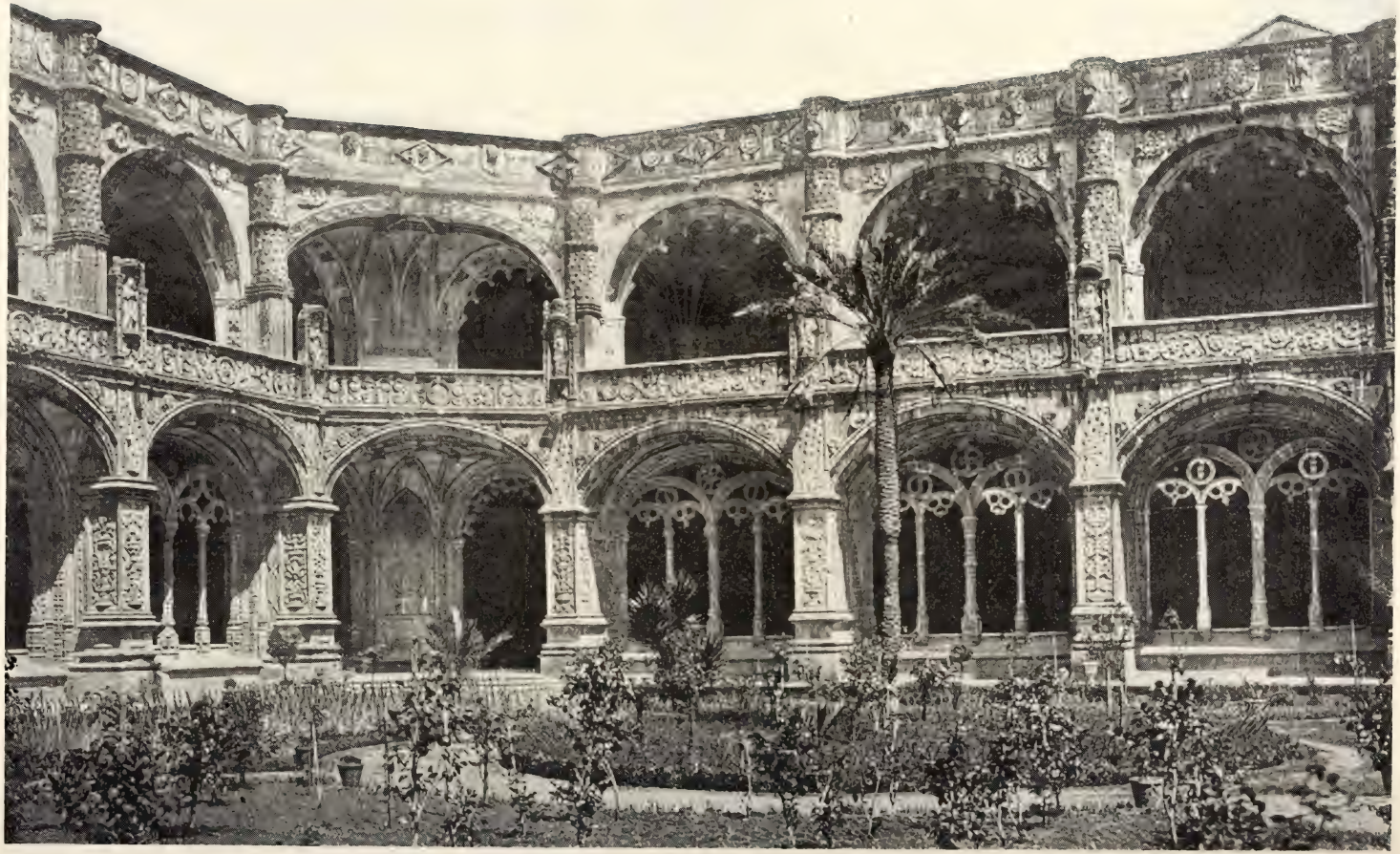


BATALHA, OR "BATTLE ABBEY," THE GLORY OF PORTUGAL

The wonder and envy of ecclesiastical architects for six centuries, and even now, dismantled as it is, one of the most beautiful Gothic structures in existence. The whole edifice is built of a marble-like limestone, which has turned to a beautiful soft yellowish cream color similar to that of an old Japanese ivory carving.

THE COURT AND ROYAL CLOISTERS OF BATALHA

Standing in the center of the court-yard and looking up at the abbey, one sees three beautiful lace-like parapets rise one above the other along the whole length, on cloister, clerestory, and nave, clear-cut edges of perfect curves against the blue sky. Each of the cloister arches is filled with stone tracery of amazing richness and variety, the cross of the Order of Christ and the armillary sphere being deftly introduced in the fretwork with great effect. This cloister, like that of Belem, seems to mark the purer and less extravagant development of the Manueline style, in which the Gothic traditions have not been entirely cast aside, and only the most callous soul could remain unmoved by its exquisite beauty.—MARTIN HUME.

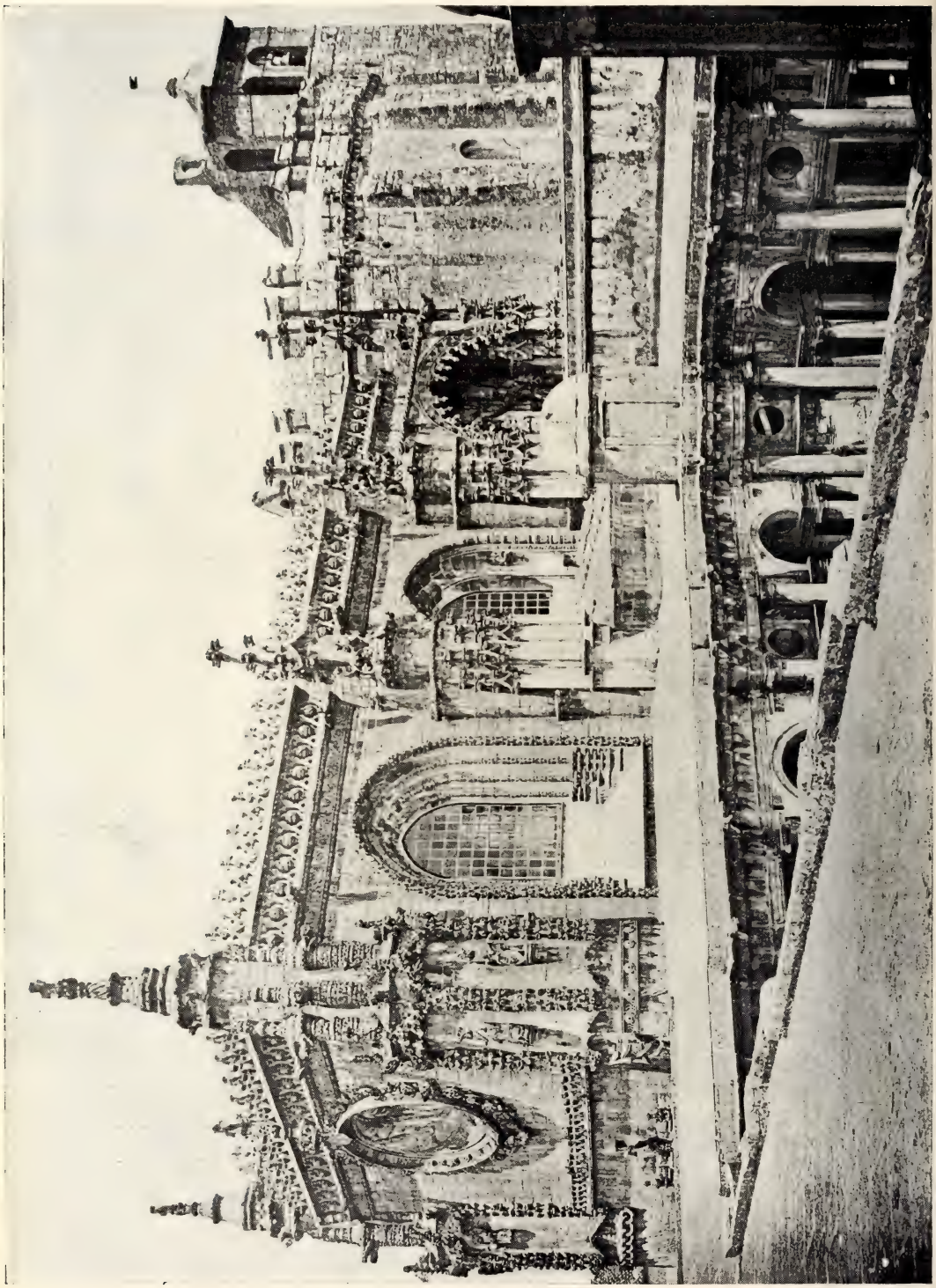


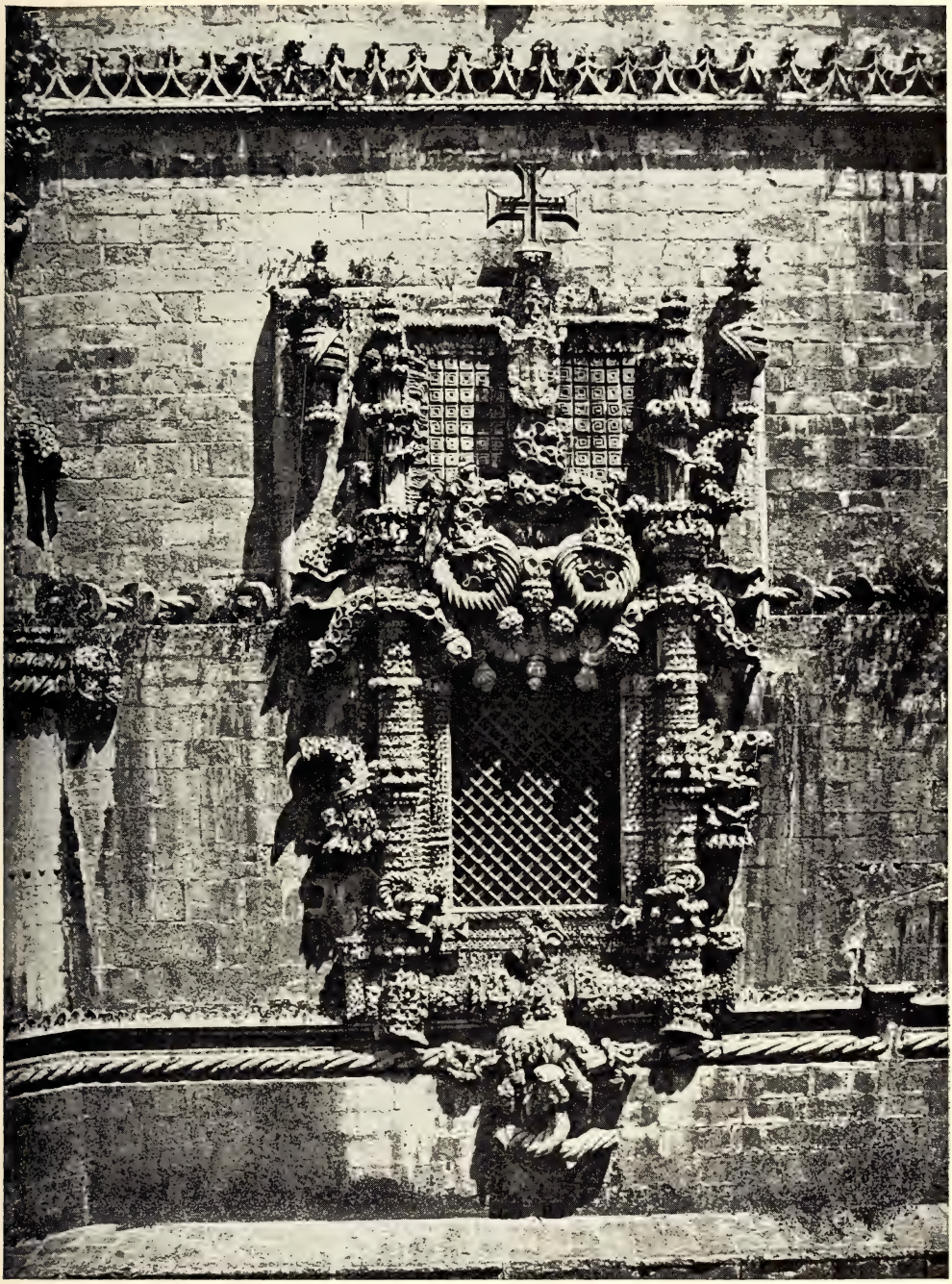
COURT AND CLOISTERS OF SAINT JEROME, AT BELEM

The monastery buildings of Belem shelter 1,200 orphan boys, who are there clothed, fed, and educated by the state, and it is a fine sight to witness them all at table in the great Manueline refectory of the vanished monks, and pleasant to hear the ringing of their youthful laughter as they play joyously in the stately cloisters.

THE PRINCIPAL GATE OF SAINT JÉROME, BÉLEM, A SUBURB OF LISBON

This monastery and church was built by the kings of Portugal to commemorate the spot where Vasco da Gama landed on his return (1498) from his discovery of the first sea route to the Indies. In richness and complexity of ornament and statuary, the gate, windows, and entire building defy description. The structure is generally considered the best example of Gothic Manueline in Portugal. Vasco da Gama is buried here.





A WINDOW OF THE CHAPEL: THOMAR

Thomar was the headquarters of the crusading knights of the Order of Christ, successors in Portugal of the Templars. The remains of the ancient fortress monastery, with its wealth of carving and exuberance of style, form one of the most remarkable sights in Europe.

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WHERE THE OLD AQUEDUCT CROSSES THE ALCANTARA VALLEY: LISBON

growing season, conduct the waters of irrigation to grass, roots, and cereal crops alike. The action of an improved Newcastle plow and a pair of 16-hand cart-horses on such cramped ground would resemble the gambols of a mad bull in a china-shop.

The Roman colonists in Portugal hit upon the most fitting implement wherewith to work such fields. It is represented on innumerable ancient bas-reliefs. The Roman plow, in its simpler form, is still the implement employed on the mountain farms of Portugal. It is drawn by the slow and amenable ox, who turns, stops, or goes forward at a word or a touch, and treads deliberately, feeling his way amid the gourds and watermelons that encumber every Portuguese stubble-field. This plow is little more than the crooked branch of some hardwood tree, cut from the nearest wood, of cornel or wild cherry, shod with iron and driven with a single stilt. It is so light that a man can lift it from the ground, and, when the day's work is done, the plowman slings it between the yokes of his oxen and thus illustrates that line of Virgil which must have puzzled many an English schoolboy:

Aspice aratra iugo referunt suspensa invenci.

All the operations of the farm, indeed, are conducted as the Romans conducted

them, except that maize has become a cereal crop in Portugal, ever since it was imported from Brazil by the Portuguese colonists of that country in the seventeenth century, and that the Portuguese have learned from the Moors the use of the eastern water-wheel to draw up the water of wells and low-lying rivers.

The vine is still trained to the poplar or the elm, as in ancient Italy, or run over lofty trellis-work, as it still continues to be in some other countries where the Romans have left their farm traditions. The wine is made today just as the Roman agricultural writers directed it to be made 2,000 years ago. The fermentation is still checked by the fumes of burning sulphur, as it was in Roman times, and the traveler who drinks the common wines of Portugal may be sure that he tastes the self-same liquor that Horace drank and sang of on his Sabine farm. There is but one difference: it was then preserved in earthen jars (amphoræ), and now in oaken barrels; but the Roman amphora, unchanged in shape and material, is still to be seen in rural Portugal. It is borne on the women's heads to carry water from every village well.

METHODS OF GOVERNMENT

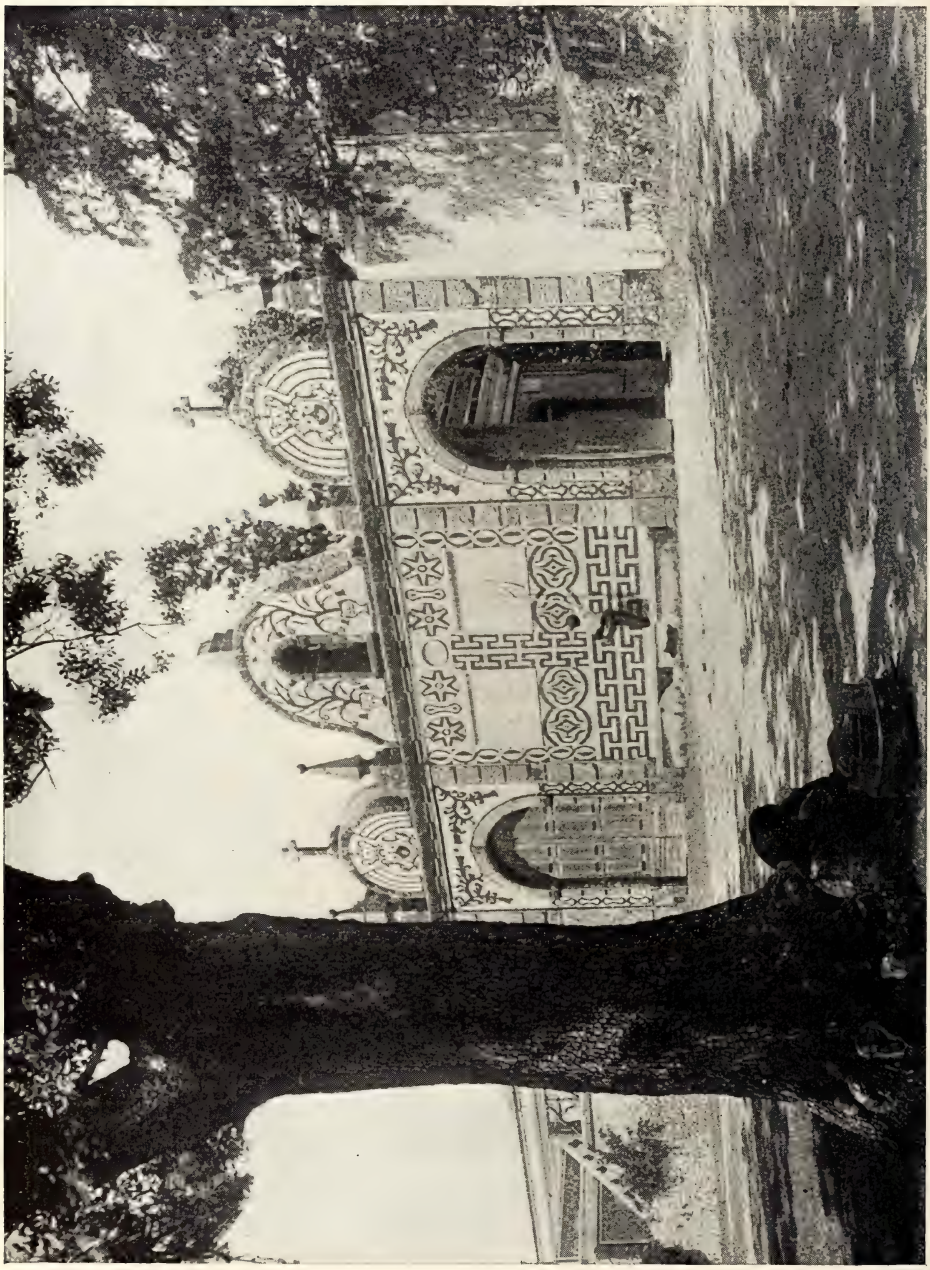
The Portuguese constitution, coming piece-meal to the country, is hardly 80 years old, and the best that can be said of it is that it took the place of very miserable methods of government, and that the Portuguese, being on the whole a shrewd and reasonable people, have made a better use of their constitution, under a line of wise and liberal monarchs, than could have been expected.

It cannot, however, be urged by the most friendly critic of the Portuguese people, that they have not been deplorably misgoverned. By common assent of the Portuguese themselves who are not active members of a political party, bribery, corruption, bad faith between governors and governed, and consequent maladministration are rife in every department of state. These facts have indeed become by-words among the people of all classes in the country. They are the topics of every-day talk in street and market-place.

The Portuguese, a wise, long-suffering people, have lived, have suffered, and have learned, too. Taking them as a whole, the Portuguese are perhaps the most unanimously patriotic people in the world. This great quality in them, existent from the remote past, is still strong, and will be sure to guide them to high issues in the future, as it has in the past. The welfare, the greatness, and the independence of their country is the end set vaguely in the mind of every self-respecting inhabitant of the country.

The modern Portuguese has somehow left his former eminence in the line of decorative art, and that he should have done so is one of the puzzles that modern Portugal presents. I will not attempt to solve it; I will only note that evidence of high artistic traditions meet the traveler everywhere. It is to be found abundantly in articles of domestic use made in Portugal two or three hundred years ago, in the fine repousé silver plate, in the faience from Portuguese kilns that have not been lighted for 300 years, in the inlaid cabinets known as Goa work, but mostly made in Portugal, and in the still more artistic cabinets, chests, tables, chairs, bedsteads, and domestic shrines of carved wood in good rococo style, worked in native chestnut or in rosewood imported from Brazil.

The now disestablished monasteries must have been rich in such work, for it is still to be found scattered in many a farmhouse. There is a still more persistent tradition of good art-work in the peasant gold jewelry to be seen on the necks and in the ears of every peasant woman on market and fair days, and on the counters of whole streets of jewelers' shops in Lisbon and Oporto. These fine-art forms derive from farther back than the plate, pottery, and cabinet-work before mentioned. They are unchanged traditions from the days of the Moorish occupancy. There are, however, extant art traditions that go further back than to Moorish times. In northern Portugal



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THE ENTRANCE TO THE SACRED WOODS OF BUSACO

On the two stone tablets are carved the papal bull forbidding the approach of woman to its precincts (see page 886)

every ox-yoke is carved with a quaint and elaborate design, the home-work of the peasants themselves on long winter nights. The designs belong to a very early period and are distinctly Gothic in character.

THE PORTUGUESE LANGUAGE

In Portugal we are in a country where three distinct races have, in turn, taken the place of the autochthonous inhabitants, perhaps mingling their blood with, perhaps after extermination or expulsion of, the race on the soil. Three separate civilizations have, in historic times, lived, prospered, and left their abiding marks in the habits and customs of the people; probably also in the blood of the actual dwellers on the land, and very patently in the Portuguese language and its literature.

The Portuguese themselves like to boast that their language is nearer to Latin than any other derived from the mother tongue of the Romans. In proof of this they have composed poems and prose passages which are fair Portuguese and fair dog-Latin. That, however, goes for little. Every foreign student of Portuguese knows that it is easy to read, it is harder to learn, harder to pronounce, and harder to understand when spoken than any other of the Latin languages. The reason is that Portuguese has borrowed very much from the Arabic word, phrase, and idiom. It has perhaps also got from the Moors some sort of Oriental uncouthness, and certainly some use of strange diphthongs which the unpracticed tongue finds it hard to pronounce. Yet it is a rich and flexible language, standing by itself, as a literary vehicle, just as French and German stand by themselves.

THE WOODS AND GARDENS OF PORTUGAL*

By Martin Hume

WHEN I opened my shutters as the dawn was breaking the next morning, and stepped out upon the wide battlements of the castle, the scene before me was so wonderful as to force from me an involuntary prayer of praise and thankfulness to God that so much of beauty should be vouchsafed to my senses. Below and around me for miles on all sides stretched the woods—woods such as I have seen nowhere else in Europe. Great palms and towering cedars of Lebanon grow side by side with oaks of giant bulk; oranges and fig trees, cork and acacia, maple, birch, and willow stand beneath the straight eucalyptus, "tall as the mast of some great admiral;" araucarias spread their spiny branches with a luxuriance never seen at home, and mosses, ivy, and ferns clothe thickly every inch of ground, every bank, and even the time-worn stones, that all around testify to the existence of dwelling here long before the white palace raised its tall tower over the darkening wood of Busaco.

Beyond the trees the shadow of twilight still lingered in the valleys and the horizon was veiled in mist, but already the sun was touching the mountain-tops all around. One range after another caught the golden light, and as far as the vision reached mountain succeeded mountain like mighty waves suddenly stayed in their onward sweep and turned into rosy rock. Here and there amidst the greenery, far below upon the plains, a white cottage, or the clustered red roofs of a village, lit up the picture with a note of emphasis, and the sweet, cool air of the mountains, fresh with the scent of pine, eucalyptus, and wild flowers innumerable, came to the jaded town-dweller like a foretaste of some exquisite

* From "Through Portugal," by Martin Hume. Doubleday, Page & Co. 1908.

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THE LITTLE OLD CARMELITE MONASTERY AND THE BEAUTIFUL NEW UNFINISHED PALACE: BUSACO, PORTUGAL

new sense to endow mankind in a fuller life to come.

Straight before me, as I stood upon the battlements looking toward the south, there rose, as it seemed, quite close a steep mountain slope clothed with a mass of verdure so thick as to look like a solid billowy surface of every tint of green, from tender primrose to deepest bronze. Here and there a straight pine or cedar, more lofty than its fellows, caught with its feathery top a glinting sun-ray and held it, whilst high up, almost overhead, upon a rocky spur emerg-

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ONE OF THE LITTLE HERMITAGES WHICH DOT THE SACRED WOODS OF BUSACO
(SEE BELOW)

ing from the foliage, there stood a humble hermitage, and on the very summit, looking so inaccessible that no human foot could reach it, a little white tower of another hermitage reared its cross over all.

On the right hand, as one looked down over the battlements, the pretty gardens of the palace, with flowers and palms, are spread at the foot, whilst, resting humbly under the shadow of the palace, is the ancient church and the tiny monastery which for centuries housed the silent Trappists, whose loving care made this holy wood to grow upon the spurs and glens of a granite mountain. Beyond

the garden the wood slopes suddenly down in billows of greenery, and then at its foot spreads the vast plain, with towns and villages nestling in its hollows. And as the sun grows in brightness, I see beyond the limits of the plain, far away, a long strip of white, and over it, high up, as it seems, above the horizon, a deep violet wall. It is the sea, the broad Atlantic, with its fringe of silvery sand many miles distant, and it gives the supreme touch to a scene of perfect beauty.

On the other side of the castle the view is just as lovely in a different way. Beyond the palms and flowers at the foot, seen over a hundred carved crockets and capricious stone pinnacles and gargoyles, with the great tower of the castle and its armillary sphere over all, is a far stretch of undulating wood, and then a vast tumble of mountains, range over range, all but the highest clothed to the top with forests, and beyond and above them all the bare granite peaks of the Caramulo range, iridescent now with the morning sun. The domain occupies the whole of the northwestern end of a long, continuous mountain ridge, some eight miles in total length, running from southeast to northwest, and extremely precipitous on all sides.

From the earliest times, at all events since the fourth century, the glens and ravines that score these slopes have been jealously guarded by ecclesiastical masters.

The sheltered position and soft westerly breezes from the Atlantic endowed the spot with a climate mild, equable, and healthful, even for Portugal, whilst the purity and abundance of the springs and the marvelous fertility of the soil in the deep, moist gorges on the mountain-side made it an enviable place of secluded residence. Whilst the minimum winter temperature is about 40 degrees, frost being unknown, the summer heat is tempered by the altitude of the place and by the abundant shade of the woods, so that the temperature rarely exceeds that of a warm July day in England.

With these climatic conditions, it is natural that this end of the ridge, protected on all sides, should develop a vegetation of extraordinary luxuriance. So remarkably was this the case, that the successive ecclesiastical bodies to which it belonged for fifteen hundred years decreed that the woods were forever to be held sacred as a place of sanctuary and devotion. From the eleventh century onward the domain belonged to the Archbishops of Braga, and in 1626 one of them granted it to the order of shoeless Carmelites as a retreat remote from the world, where the monks following the strict Trappist rule might meditate in silence, undisturbed by the turmoil of their fellow-men.

In poverty, and with the hard labor of their own hands, the monks built the little monastery and humble church as they now stand, with other portions since demolished, and, year by year, for two hundred years, planted and tended with devout care the sacred wood which was their one earthly concern. From all quarters of the globe where the Portuguese flag waved, from India, South America, and the Far East, rare plants and trees were sent by Carmelites to their beloved "Matto de Busaco." Medicinal herbs, rare and lovely ferns, and exotic fruit and flowers, impossible in other places in Europe, here grew luxuriantly, and the silent, white-robed gardeners planted and tended their domain until it became, not a wood, but a sylvan garden of surpassing beauty, as it remains today.

A high wall shuts it in from the rest of the world, whilst a special Bull of Urban VIII, deeply cut to this day upon a great slab on the principal gateway, condemned to major excommunication any person who violated the sanctuary or injured any plant within the sacred precincts; and another papal Bull bans any woman who dares to set her foot upon the domain. Beautiful terraced paths were cut upon the hillsides, and, zigzagging down the ravines, fountains that gushed spontaneously from the mossy rocks were dedicated to saints and adorned with sculptured shrines or rustic grottoes.

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TYPES IN COIMBRA (SEE PAGE 889)

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ON A STREET CORNER: OPORTO, PORTUGAL

Everything that single-hearted toil and devotional spirit could do, for centuries the shoeless Carmelites did for their remote monastery and the fairy glens of Busaco, and since the abolition of the monastic orders in Portugal, the government have tended and guarded the spot as carefully as the silent monks before them.

As one trod the old path of the pilgrimage, up mossy steps and past despoiled shrines, with glimpses of sunlit glades and shady green dells, it was impossible to shut away from one's thoughts those generations of silent, white-clad figures who, shoeless, had toiled so often up the Via Dolorosa, with tears of penitence, perhaps agonies of regret, for the life from which they had fled. All around were relics of their unrecorded labor. Sculptured stones, chapels, hermitages, fountains, grottoes, and shrines were all built by their patient hands; paths scarped on steep hillsides, seats placed in quiet nooks for the meditative and weary; nay, the trees and plants from all lands growing so proudly now, had all been tended anxiously by the same dumb shadows that for centuries waited for death within the walls enclosing the sacred wood. If ever a place was haunted by sad, harmless ghosts,

these paths of pilgrimage at Busaco must still be thronged by the white-robed phantoms of those who made them.

From Busaco our road to Coimbra lay downward for a mile or two, through a beautiful country of pines and gorgeous stretches of purple heather in full bloom, and here and there long trellised vineyards, with the red bronze of the vine leaves adding a splash of color to the scene.

Patient ox teams toil along, led by small boys in black nightcaps, gravely courteous to the stranger, and black-eyed solemn children play soberly by the wayside and take no heed. Soon we pass through the big, poor-looking village of Pampilhosa, and leave the pines and heather behind us, for here down in the valley olives, cork trees, ilex, and vines abound, with figs, pears, and apples, in orchards nestled round the white cottages. Aloe hedges, with the big, fleshy lancet leaves of silver-gray, show that we are in a sub-tropical land, and patches of succulent sugar-cane for cattle fodder grow brilliantly green against the maize and millet fields, whilst all along the wayside the light-leafed poplars rear their straight shafts, heavily burdened by masses of purple grapes and flaming vine leaves, the only sign of autumn, though October is now upon us.

As we near Coimbra, though it is not much past noon, we met many groups of handsome country women, with, as usual, heavy burdens upon their heads, returning home from the weekly market in the city. Barefooted they go invariably, with their fine, broad shoulders, full bosoms, classical faces, and broad, low brows, their gay kerchiefs on head and bosom, and their fine eyes gazing straight forth with modest dignity, and mentally I deny assent to the boast of Guimaraes that its maids and matrons reign supreme in buxom grace, for those of Coimbra need bow the head to none on earth.

Coimbra is crowded with memories of the heroic times, of combats with the Moors, and of deeds of violence and blood perpetrated within its walls, and in its quaint crowded streets are corners that can hardly have changed since the Affonsos and Sanchos here held their court.

THE TRAGEDY OF INES

The heat was oppressive on the morning after my arrival at Coimbra, but a pilgrimage to the shrine of Saint Isabel the Queen, and to the shrine of love near to it, could not be foregone. Crossing the bridge, I first wended my way to a beautiful villa almost on the banks of the river, in whose grounds there stands the gothic ruin of a palace, and adjoining it, gushing from a rock shaded by dark cedars, a copious spring leaps joyously along a stone channel of some twenty feet long into a stone tank covered with water lilies.

It is a lovely, tranquil spot, where no sound reaches but the rustling of leaves and the gurgling of crystal water, and yet here, tradition says, was enacted in the long ago one of those tragedies that inspire poets, painters, and dramatists for all time. It was in 1355, and Ines de Castro, the lovely mistress of the Prince Dom Pedro, had so infatuated him that he refused to marry another at his father's bidding. The king, Alfonso IV, incensed at the recalcitrancy of his heir, caused Ines to be done to death here beside the "Fountain of Love" by three courtiers.

The son, Dom Pedro, rose in rebellion, and saw his father no more; but when, two years afterwards, the king died and Pedro succeeded him, he worked his ghastly revenge upon those who had persecuted his beloved. Ines had been buried at Santa Clara, the convent near to which this estate belonged, and now her body was disinterred, dressed in royal robes, crowned with a diadem and adorned with jewels, and placed, a crumbling corpse, thus arrayed, upon a throne in the monastery-church of Alcobaca, whilst all the courtiers, upon their knees, kissed the dead hand of her whom they had insulted and contemned in life.

"The fountain of love in the garden of

THE ROYAL SUMMER PALACE AT CINTRA, NEAR LISBON, "THE CASTLE OF PENHA"

Originally a Jeronomite monastery built by King Emmanuel to commemorate the voyage of Vasco da Gama (see page 894)

tears" is the spot called to this day, and a crumbling little gothic convent founded by the lover king between this and the river bears the name of "the convent of tears" (see illustration, p. 872).

Coimbra is famous as the seat of learning for all Portugal—for many centuries, and still, the only university town in the realm. The huge square bulk of the university buildings on the crest of the hill overlooking the town typify the absolute domination of the place by the academical tradition. The hotel on the Alameda, like other hostelries of its sort, has no lack of commercial customers, but even they, assertive as they are, are swamped by the university professors, staff, and graduates who flock to its tables for their meals, whilst in the streets bookshops jostle each other, all filled with text-books, and the unmistakable students are everywhere.

There was some stay at Pombal, where it was a feast day, and the peasant costumes were seen at their best—good, upstanding people these, gaily clad, sober, and orderly, coming to the railway stations in good time and unhurried, but not hours before the train starts, as the peasants do in Spain.

In the market, under the shadow of the great mediæval castle ruins on the hill, they do their buying and selling, livestock for the most part today, without vociferation, but with an earnest quietness which is as far as possible from depression. Here at Pombal, and at Albergaria, near, the men wear brown, undyed homespun jackets and trousers girt with red sashes. The bag cap is almost universal, and mutton-chop whiskers are the rule, but what will attract a foreign visitor most in their dress are the curious triple-caped ulsters, made of layers of grass, seen in many places in Portugal in wet weather, but especially in this neighborhood. These garments, bulky as they look, are not heavy, and are

THE ROYAL PALACE OF CINTRA

The strange-looking towers, commonly called "champagne-bottle chimneys," are the chimneys to the great fire places where oxen were roasted whole

an excellent protection against heavy rain.

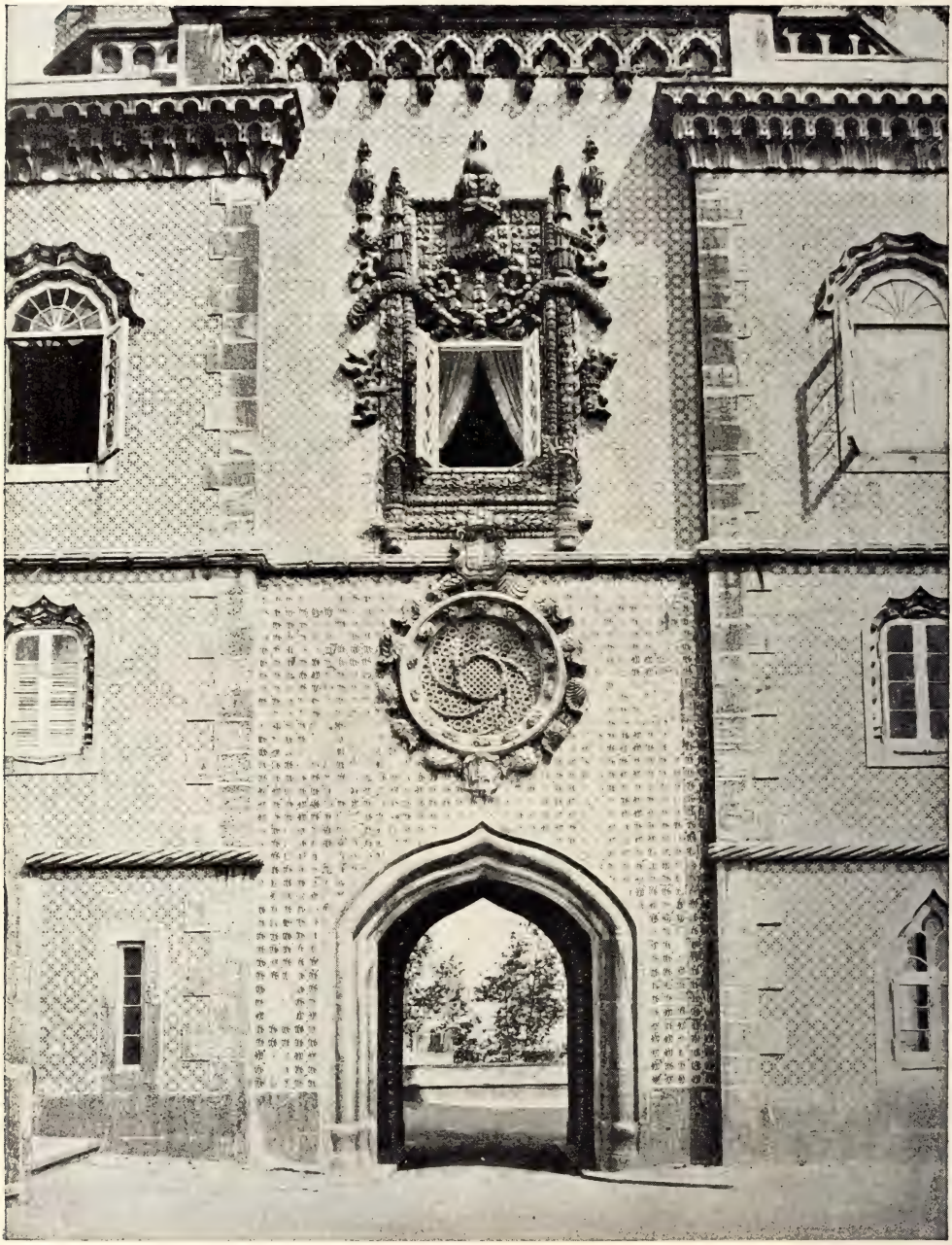
The women here have very full, short, gathered skirts, and though none of them wear shoes or stockings, hardly any are without heavy ancient jewelry of gold filigree, apparently of considerable value.*

The bodies of the dresses are mostly red or yellow, and a broad horizontal stripe of bright color often enlivens the skirt also, their brilliant head-kerchiefs being

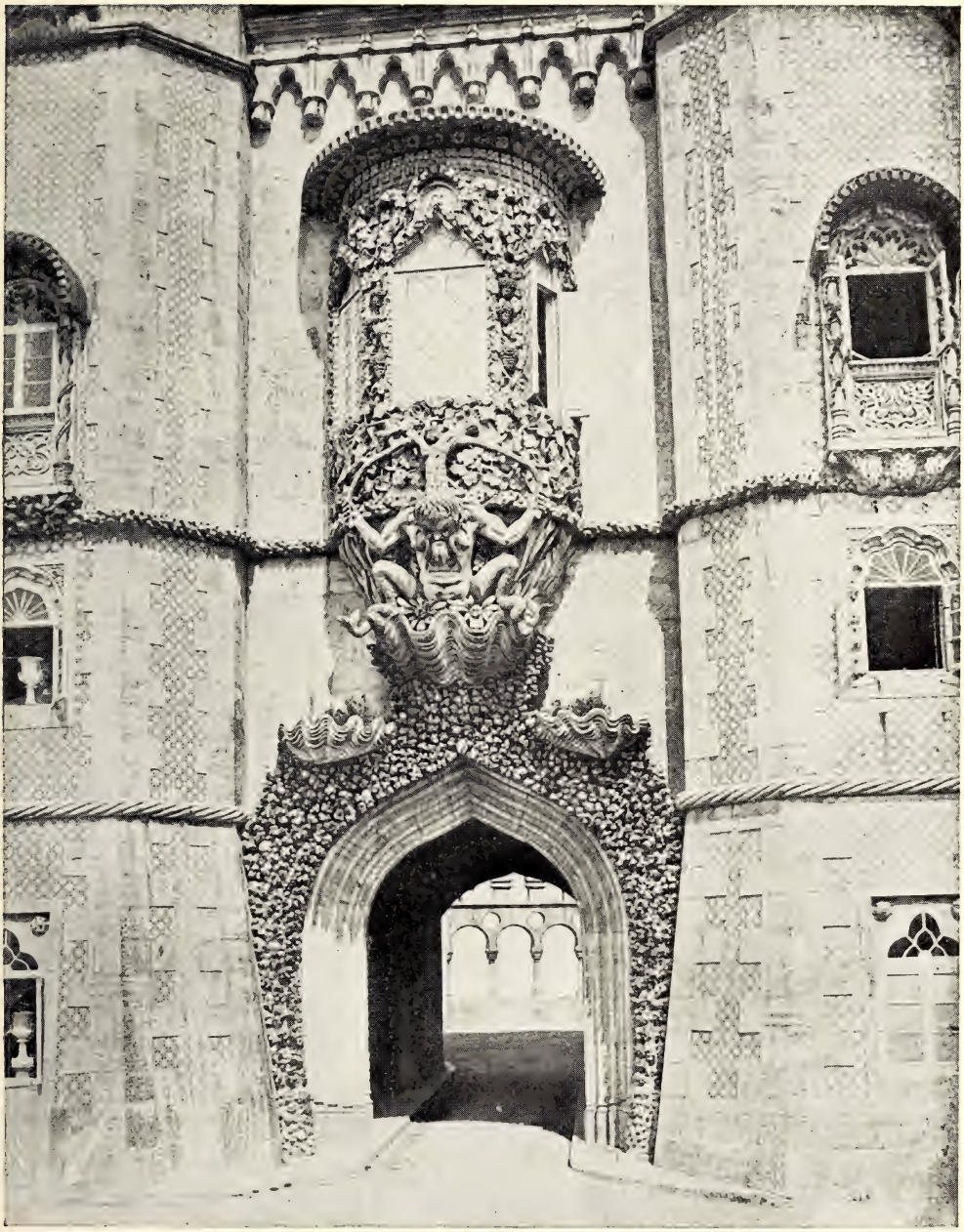
* In this connection it is interesting to read the following quotation from "The Tourist in Portugal," by W. H. Harrison, published as long ago as 1839, by D. Appleton & Co.:

"It is not uncommon, in some of the provinces, to find women who have not a shoe to their feet, ornamented by necklaces of gold, some of them of great value. Mrs ——, the lady of a merchant of Oporto, related to us an odd anecdote of a servant whom she had obtained from the country. The girl entered upon her vocation with every appearance of being quite competent to its duties, as indeed she proved to be; but, to the great annoyance of the English prejudices of her mistress, she wore no shoes. The lady mentioned the circumstance to the girl as unusual in English families; but was answered by the domestic that she wore stockings, which was more than servants in the country did, and that she deemed that a sufficient concession to the fastidiousness of a foreigner.

"The lady perceiving that, independently of the want of shoes, the domestic's wardrobe was deficient in what her mistress judged to be very essential articles of dress, and conceiving that want of funds on the part of her new servant was the cause of their not being procured, kindly volunteered an advance on account of wages. The offer was, however, received with some marks of indignation by the domestic, who opened her box and displayed a wealth of jewelry, in the shape of gold necklaces, which quite astonished her mistress, and which was adduced as irrefragable proof that, if she was not provided with the articles that were deemed necessary to her equipcent, it was not for want of the means of purchasing them."



ENTRANCE TO THE SECOND COURT OF THE CASTLE OF PENHA: CINTRA



BALCONY AND PRINCIPAL GATE OF THE CASTLE OF PENHA: CINTRA

usually topped by a broad-brimmed velveteen hat, for the pork-pie hat of the north has been left behind now.

THE GREAT PALACE AT CINTRA

Like the similar mountain of Busaco, the "Rock of Lisbon" is scored by ravines and dells innumerable, sheltered valleys open to the soft sea-breezes charged with grateful moisture, and from time immemorial the luxuriance and variety of its vegetation have been proverbial. At a time when Lisbon, only some 15 miles away, is sweltering and breathless within its south-facing semicircle of hills, the slopes of the mountain of Cintra are fresh and invigorating, and some of its gardens are a veritable paradise all the year round.

The village of Cintra lies in one of the folds of the great hill, at perhaps a third of its height up the side.

Sheer aloft upon a precipice a thousand feet and more above its roofs there stretch the mighty battlements and massive keeps of a huge castle of fawn-colored stone—a castle so immense as to dwarf Thomar, Leiria, and even Obidos almost to insignificance. Long lines of crenellated walls following the dips and sinuosities of the crest of the peak appear to grow out of the mighty rounded boulders, some of these great masses of rock seeming to hang over perilously, as they must have done for thousands of years, top-heavy and threatening.

The fortress must have been impregnable by force, and indeed was only gained at last from the Moors by treason, the gate having been bought by the Christians from an unfaithful guardian. A narrow path cut on the face of the precipice is the only practicable approach to the fortress, and leads soon to yet another gate flanked by a strong tower built upon one vast, solid boulder. Yet another strong gate tower we pass through, and with a sudden turn we are inside the fortress, on the right of us a ruined chapel, once a mosque, and on the left a watch-tower, with, at its foot, a monument on which the cross is graven surmounting the crescent, emblematical of the fate of the adjoining chapel.

To describe in detail this prodigious ruin would be impossible in any reasonable space. The summit of the crag consists of two separate peaks at some distance from each other, the higher one occupied by the main keep, "the royal tower," and long battlemented walls reach from one point to the other, with bastions at intervals and massive square keeps at the salient angles. On all sides within the great enclosure formed by the battlements, covering the whole summit, remains of towers and buildings of various sorts are scattered amidst the dense growth of trees and brushwood that have intruded upon the space. The battlements are strong and perfect still, and it needs but little imagination to people them again with the turbaned and mailed warriors, sheltered snugly behind them, watching for the advancing hosts of the Christian king, certain that, so long as Islam was true to itself, no force could take this stronghold of their race.

Upon the highest point of the rock of Lisbon was King Manuel the Fortunate wont to linger for hours and days for many months together, climbing up from his palace in the town below, that he might gaze far out upon the Atlantic, watching and praying for the return of Vasco da Gama from his voyage to India round the African continent, the route that in two generations the impetus of Prince Henry the Navigator had opened.

There was but a tiny Jeronomite hermitage or penitentiary here in this savage eyrie to shelter the anxious king, and during his vigil he vowed that if the great explorer came home successful he would build upon the spot a worthy monastery of the order in memory of the event. The work must have been a prodigious one, for even now the place is hardly accessible by carriages, and the quantity and the weight of material necessarily brought from below was enormous.

This monastery, like the rest, was disestablished and secularized by the state in 1834, and King Ferdinand, the consort of the Queen of Portugal, and a first cousin of Queen Victoria and Prince Albert, bought the building for conversion into a royal palace.

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THE NATIONAL GEOGRAPHIC MAGAZINE

GLIMPSES OF KOREA AND CHINA

BY WILLIAM W. CHAPIN, OF ROCHESTER

With Photographs by the Author

KOREA, the little nation which has been so carefully watched by the Powers during the past few months as she has been undergoing the process of being taken over by her powerful neighbor, Japan, is, considering the rapidity of the changes through which she has passed within 30 years, a country of unusual interest. Comparatively little was known of her prior to 1882, as up to that year she was a hermit nation, satisfied with her own resources and conditions, only anxious to be left undisturbed. Indeed, previous to that date, it is said to have been death, not alone to the foreigner who landed on her shore, but to the native who gave him shelter.

A land so oriental, full of unusual scenes, and customs so strange, but recently opened to the safe inspection of foreigners, and withal so accessible to travelers in Japan, furnished considerations which impelled us to brave the perils of the Korea Strait and embark from Shimonoseki for Fusan.

Our ship was to sail at 9 in the evening, and the promptness after we boarded the steamer with which we sought our berths proved that the rumors which had come to us regarding the discomforts of the rough passage were thoroughly believed. On awakening several hours later, as we glanced from our porthole at the gentle rippling surface of the sea, sparkling in the glory of the full moon, a scene so at variance with the conditions we had expected, our first thought was that we were in a dream.

The long dock at which our steamer landed at Fusan was alive with people, most of them coolies, in white clothing and with long hair in an untidy coil, worn on top of their heads, waiting to transfer our baggage to the railway station, half a mile distant. This is done by means of peculiar racks carried on the back, in which not only baggage is borne, but every conceivable thing, even to live animals. Were the tourist to journey to Fusan alone, he would feel amply rewarded for visiting this gateway city, even if the crossing proved as rough as is sometimes experienced.

One can hardly realize that such a change of scene is possible after only 10 hours of steamboat travel: the people, their occupations and habitations, not to mention their wearing apparel, the dress of the men and the undress of some of the women—all being most remarkable. One of the attractions of this city is the

fish industry. The early morning catch is transferred to the docks, where the fish are sorted and disposed of either by sale or packing for shipment. In this work the native women take an active part.

In approaching the station we passed a section of the highway where grading was being done. The earth was first loosened by a queer implement—a hoe with long flat prongs—in the hands of men whose dusky forms were nude to the waist. Others were operating a three-manned shovel, a tool peculiar to this country, being a long-handled scoop from which two ropes extended. While the one holding the handle guides the implement, the two others furnish the power by pulling the ropes from a distance of about 12 feet. Judging from the results of their united efforts, it would require several to accomplish as much as could one able-bodied son of Italy, armed with an ordinary shovel and wheelbarrow.

The railroad of Korea, like most of those of Japan, is owned and operated by the Japanese government. The train which conveyed us northward much resembled those in our own land, and included a dining-car. The line follows for a long distance the course of the Raqutoka River, passing through several tunnels, some of which are of considerable length. The door-yards and houses seen from the car windows are surrounded by substantial stone walls, and, judging from the appearance of the numerous groups of children, tan-colored undressed kids were quite in style.

Before reaching the principal towns, train-boys passed through the cars informing each passenger that the train would stop so many minutes at the next station. On arrival, a rush was made by the passengers, mostly Japanese men and women, to the long wash benches at one side of the depot, which were provided with basins and running water. And the way they would souse their arms and faces, the men including their hair and necks, revealed a new trait in these little people.

Hot tea was furnished gratuitously and four times during the day was passed in cups on trays through the cars, to take the place of the ice-water tanks with which American coaches are equipped, for it is unsafe to drink unboiled water here as in Japan.

Along the route of the railroad, trees are very seldom seen and no apparent effort is being made to reforest; indeed, a tree in this country stands but little chance, even the branches to the smallest twigs being tied in bundles of uniform size, the roots, too, dug up, and all loaded on the backs of men or oxen, brought to market, and sold at so much per pound. A frequent object seen on the streets of Seoul is a mass of brush moving slowly along, it sometimes being difficult to determine by what motive power, so obscured is the animal by its load.

At a suburban station our car was entered by a nice-looking native, wearing the dress of the better class, who, in well-spoken English, solicited our patronage for the "Astor House," Seoul, Korea. At once visions of sumptuous repasts and faultless service enjoyed years since in lower Broadway arose in our minds and we decided to locate there. Upon inquiry we learned that the gentleman's name was "Sin Song," and that representing the hotel occupied his time only when he was not employed as courier for tourists; so, on the strength of appearances, his services were at once engaged for our entire stay, and we were most fortunate in our choice, as he proved satisfactory in every way. As an evidence of the enterprise of the young man, I will state that, although a Romanist, he was a member of the local Young Men's Christian Association, which has an attractive building and is in a prosperous condition.

Before visiting the points of interest in Seoul, which is the seat of government, let us consider briefly some facts pertaining to Korea as a country. Korea, although usually considered a peninsula, is in reality an island, 175 miles of its northern boundary being the River Yalu and the remainder the River Turnen, both of which are outlets of the same lake in the Northern Mountains, the

THE THREE-MAN SHOVEL: FUSAN, KOREA (SEE PAGE 896)

GRADING NEAR THE HIGHWAY: FUSAN, KOREA

KNEADING BREAD ON THE STREET: SEOUL, KOREA (SEE PAGE 902)

former flowing west and the latter east. The dimensions of Korea are about 135 by 600 miles, with an area, including its numerous small islands, of about 100,000 square miles—not far from the size of New York and Pennsylvania. The arable land comprises only about one-quarter of its surface, a range of exceedingly barren mountains and scantily clad hills extending its entire length. Its population, estimated from the number of houses on which taxes are paid, is 12,000,000, or 159 to each square mile. As a comparison, that of England is 500; Japan, 284; Germany, 250, and the United States 21. The climate is about the same as New York and Pennsylvania, excepting a season of six weeks of the wettest kind of rain.

Raising of rice is the chief occupation of the people, although Korea is said to be the fifth largest cotton-producing country in the world. In customs and looks the people resemble the Japanese in some ways, and although they have many noticeable peculiarities, laziness, as some writers have charged, is not one of them. Many varieties of fruit thrive and the country is rich in coal and nearly all mineral products.

White clothing is the emblem of mourning in Korea, as it is in Japan and China; the mourning period is three years. On the occasion of the death of a royal personage the entire population must put on white. This custom is said to be accountable for the people having adopted white clothing for ordinary wear, that they might be ready for the inevitable when it should come, either in their own or in the royal family.

The distinguishing feature in the clothing of the male Korean mourner is the material, which is unbleached linen or sackcloth bound at the waist with a rope girdle for the loss of a father, or one made of strips of cloth for a mother. In his hands the mourner holds a sackcloth screen about one foot square, with which to hide his face when passing along the

street. The mourning hat, while enormous, must be much more comfortable than the every-day fly-trap sort. It consists of a creation of straw and bamboo, shaped like a wooden chopping bowl, the edge of the rim being a coarse scallop, which distinguishes it from the one worn by peasants. The mourning hat as a setting for the solemn oval face of a Korean produces an appearance of extreme sadness.

The conventional clothing of the men is more striking than comfortable, as was demonstrated by my having a complete suit made to order. The foot is crowded into a cloth stocking not the shape of the member it is designed to fit, but, like the shoe, narrow at the toe and turned up to a point similar to a clown's foot covering. The dry-weather shoes, of coarse black cloth, low as slippers, their snug fit being depended upon to hold them in place, were found extremely uncomfortable.

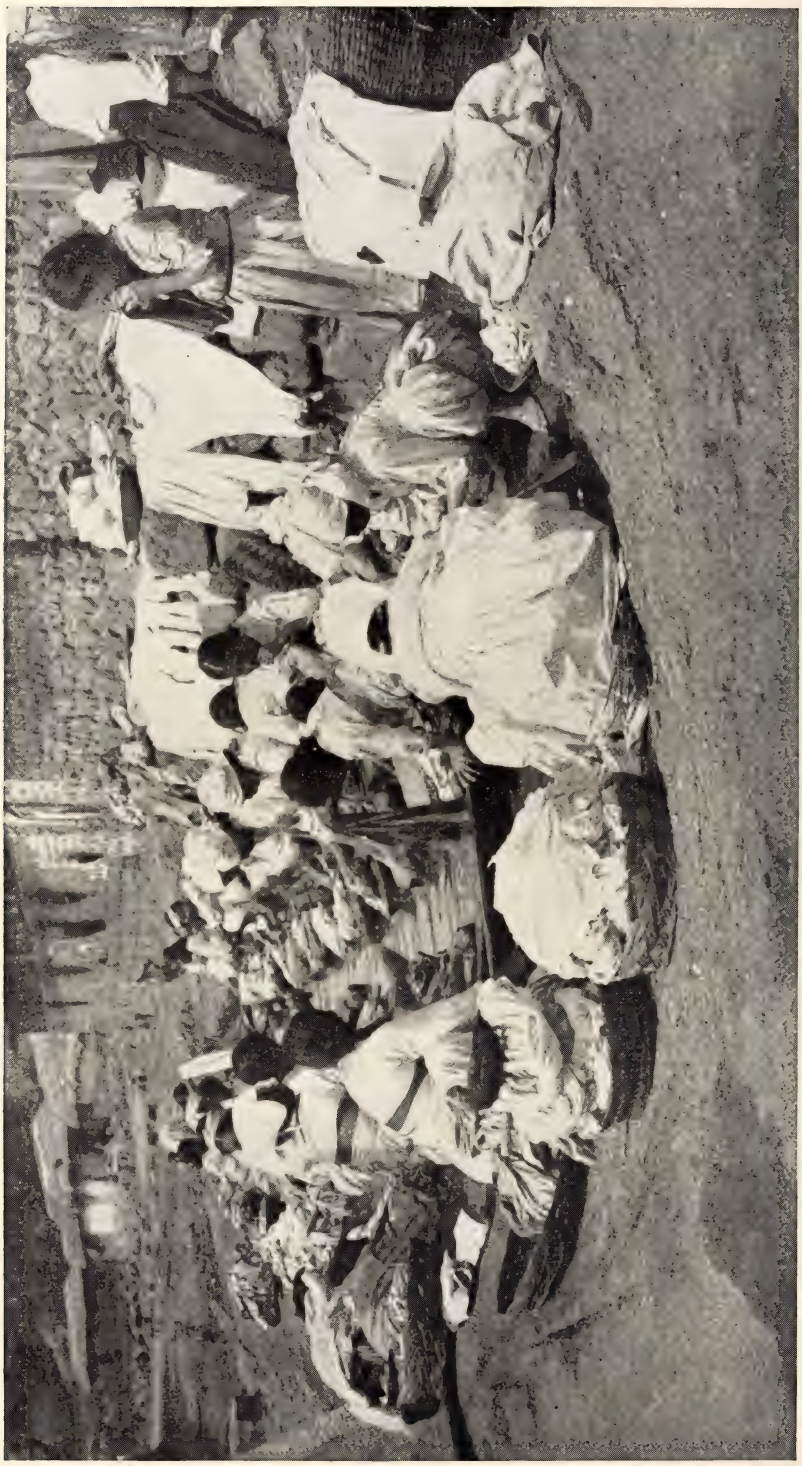
The trousers consisted of a pair of pillow-cases having a wide waistband, not too uncomfortable in warm weather were there some other arrangement for holding them in place less confining than the narrow braid which is used as a belt. The padded waist is covered with a green silk waistcoat, the long unlined overgarment being of thin, gauzelike material, almost transparent, in a delicate blue, reaching below the knees. From the belt on the left side are hung two cases, one containing a small knife and a pair of chop-sticks, the other a pair of grotesque spectacles of smoked glass the size of silver dollars, set in a clumsy bone frame. On the right hang bags for money and tobacco. All of these cases are embroidered in bright colors.

In the hand is carried a plain fan, while the outfit is crowned by an absurd little pill-box hat, which, when worn by a native, is perched on a tightly-coiled queue and tied under the chin with a plain black tape, supplemented in the case of men of wealth or distinction by a chain constructed of two-inch pieces of the smallest-sized bamboo separated by amber beads, hanging from either side of the hat, under the chin and thence to the waist. The rim of the hat is of fine bamboo, while the upright part is of horsehair, so loosely braided as to expose the hair of the wearer to view. For rainy weather they have as a covering for the hat a peculiar round, helmet-shaped oil-skin, pointed at the top, which is drawn on and tied under the chin. When not in use this covering is folded in pleats like a fan and carried in the folds of the waistcoat.

The clothing of the wealthy Korean is of the same cut, but differs from the above simply in cost of the material; the coat being of silk and the hat of finer weave, the latter sometimes costing $20. The coolie and laboring element wear similar clothing in shape as those in the upper classes, but of a cheaper material and without waistcoat and over-garment. In place of the hat a head-cloth is sometimes worn covering the hair, the corners being turned upward above the forehead; most of them, however, wear only the queue coiled on top of the head.

The dress of the laboring class of women consists of a jacket or waist which extends about three inches below the armpits, while the skirt has only a tightly drawn band, thus exposing to view several inches of dark-brown skin between the waist and skirt-band. This condition seems more unaccountable, since women of the middle class never appear on the street without wearing a white skirt over the head and face in such a manner as to enable them to see their way without exposing even their faces to view, while others wear a green or red long-coat, hung in the same way and reaching to the knees; this garment, although having sleeves, is only worn as a veil. The higher, wealthy class of women never appear on the street except within the seclusion of the closely curtained chair borne by coolies.

In place of the street covering for the head, some of the reformers carry open umbrellas both in daylight and darkness, not as a protection from rain, but as a screen from the gaze of the naughty men. This seems rather amusing, since



THE WASHERWOMEN OF SEOUL, KOREA, WASHING IN THE SEWER (SEE PAGE 902)

THE BULLOCK—THE BEAST OF BURDEN OF KOREA

the purpose for which men carry fans is said to be to protect them from the eyes of the women. In their home life the women wear very bright, solid colors, without regard for harmony, waist, skirt, silk purse, and other ornaments being all at variance.

If a tourist flatters himself that he has escaped the lure of the curio dealer by crossing into Korea, he will soon discover it to be a case of jumping from the frying-pan into the fire, as some of the old brasses offered here at "ruinously low prices" are most attractive. Much of the work is crude and coarse, but when one sees the tools and the manner of handling them, the wonder is that such good results are obtained. The articles offered include oak chests and cabinets, almost entirely covered with brass plates, hinges, and trimmings. The former are locked with great padlocks of antique design, nearly as large as some of those seen on the gates of the walled cities. Braziers, vases, incense-burners, tea-kettles, and the high candlesticks peculiar to the country are among the smaller articles for sale. By exercising great care, our Sin Song secured for us a fine specimen of a cabinet and chest guaranteed antiques. As the stock of genuines is getting low, these wily craftsmen are offering recently manufactured close imitations of the old models, so the tourist without experienced assistance is at their mercy.

One of the first objects of interest we visited was the public park, an enclosure filled with fine trees, flowering shrubs, and roses in variety. It was such a place as would do credit to any country, with its well-kept lawns and tea-house of handsome outlines standing near the white marble pagoda. The latter structure is unlike those bearing the same name in Japan, being more the form of an octagon, with the shaft ornamented its entire length with carvings. It was erected 1,600 years ago as a monument to Buddha. In 1580 the top, comprising about one-quarter of the whole, fell, and now stands close beside the main part.

A few steps beyond and placed here at the same time is another monument, designed like an enormous turtle, the emblem of longevity. It is cut from one stone, bearing a tablet on its back. After a close examination it appeared so

well preserved that one of our party exclaimed that it did not look a day older than 1,599 years.

The main streets of Seoul are wide and well laid out. The stores generally are but one story, hardly deserving the title of buildings. On a pleasant day these thoroughfares present a very animated scene, the white clothing giving a prominence to each wearer, bringing him into view as far as the eye can reach. The means of conveyance over the roads, for the most part unpaved, is rickshaws drawn by boys who are swift and tireless. On one side of the main street were double tracks of a dilapidated horse-car line, which with the electric light and telegraph poles were evidence that intercourse with outside nations had not been without advantage.

The street scenes of Seoul offer great variety for the kodak, the burden-bearers of both sexes furnishing a constant change of scene; most of them being willing victims, entirely satisfied with a small tip. At the wood market on one side of the main street the patient steer is seen reclining under the weight of a load of logs which would cause a wagon to groan, and one wonders how he will ever regain his footing when his master makes a sale and the time comes to deliver the goods. These animals appear to thrive under their burden-bearing, being sleek and well kept.

At a turn of the road we encountered three coolies, each bearing a live pig, which must have weighed twice as much as the coolie himself.

The guardians of the peace were much in evidence, and in place of carrying the usual locust club they were armed with swords. Frequently one or more of these policemen were met preceded by from two to six culprits chained to each other by the waist, carrying tools for cleaning or repairing the streets, en route to some part of the city where they were to work.

The native bread of Seoul does not seem very attractive to foreigners after they have seen the process by which it is made. However, if its excellence was alone dependent on the thoroughness with which it is kneaded, the bread which "mother used to make" would suffer by comparison. After mixing, the dough is placed on a board in the road in front of the little bakeshop. Then two stalwart Koreans proceed to pound it with great beetles. It is not claimed that the quality of the bread is improved by the addition of impurities in the way of insects and dust which naturally result from the open-air treatment, but if one objects to eating it, a native will quote a proverb which, being interpreted, runs, "He who would enjoy his food should not look over the kitchen wall"—a maxim not without force in countries occidental.

The poor, neglected children seen on the streets and in the courts without a stitch of clothing to cover their dusky little bodies enlisted our sympathies. We recall one baby boy in particular to whom the accomplishment of walking alone was so new that he toddled with uncertain steps across the narrow road, and while attempting to gain the sidewalk rolled into the shallow ditch. Although in a decidedly soiled condition, he picked himself up and made his way toward where we were waiting to kodak a woman who was approaching bearing a basket on her head. The result was that they both reached the spot at the same instant that the bulb was pressed. We returned the youngster to his home with thanks.

The temples visited in the region of Seoul were found to be very ordinary and much neglected.

The occupation of laundress in this land, where the clothing of both men and women is white, of necessity employs large numbers of women. The seamstress, too, must have plenty to occupy her time, since most of the garments are taken apart at the seams before washing. Almost a daily sight was bevies of women lining both sides of small drains or sewers occupied in washing clothes. While not neglecting the object of the gathering, they were not unmindful of its social features, singing, chatting, and laughing to the accompaniment of the flat clubs, as they

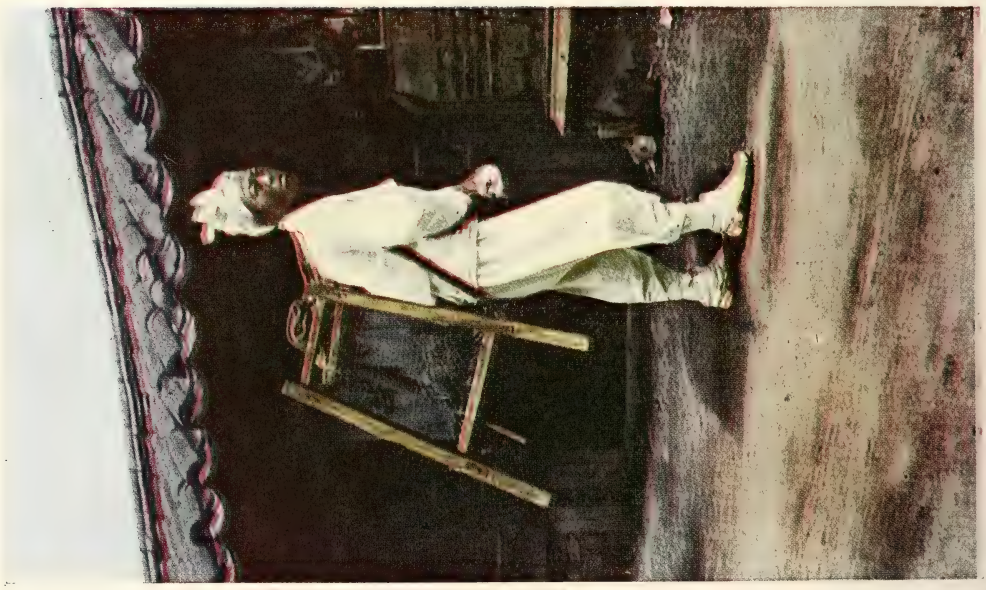
PEASANT IN RAIN-COAT AND HAT: SEOUL, KOREA

CARRYING SWINE TO MARKET: KOREA

THE WOOD MARKET: SEOUL, KOREA

THE TIMBER MARKET: SEOUL, KOREA

PEASANT WOMAN: SEOUL, KOREA



POULTRY PEDDLER: SEOUL, KOREA

KOREAN LABORING WOMEN: SEOUL, KOREA

KOREAN COOLIES
(Showing racks for carrying baggage, as seen on arrival of ship at Fusan, Korea.)

KOREAN GENTLEMEN

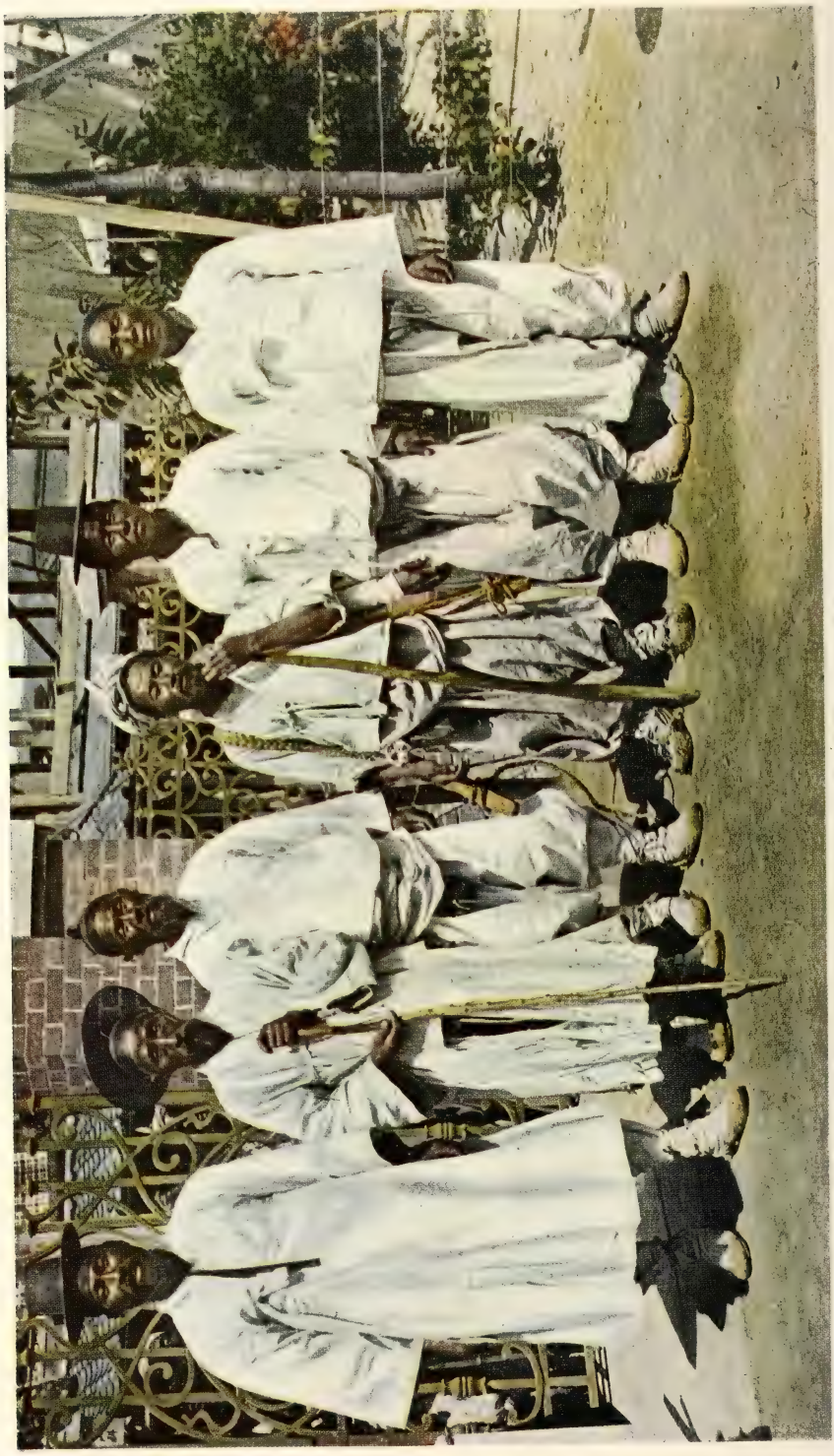
BUDDHIST NUNS: NEAR SEOUL, KOREA

THE LAUNDRESS AND STREET BABY: SEOUL, KOREA

A LOAD OF BOTTLES: SEOUL, KOREA

POTTERY CARRIER: SEOUL, KOREA

PEASANTS: SEOUL, KOREA
(Street scene)



KOREAN CITIZENS: FUSAN, KOREA
(Group inside Municipal grounds.)

KOREAN COOLIES: FUSAN, KOREA
(Boys at the dock.)

BURDEN BEARERS: STREET OF SEOUL, KOREA

HIGH-CLASS WOMAN'S CHAIR: SEOUL, KOREA

FUNERAL CAR: SEOUL, KOREA

KOREAN MOURNER
(Holding face-screen.)

AS WE LOOK IN KOREAN GARB

THE WHITE BUDDHA: NEAR SEOUL, KOREA

GUIDE SIN SONG AND FAMILY
(Inside court; entrance to home. Group consists of Sin Song, wife, child, and wife's sister.)

ONE OF THE CITY GATES: SEOUL, KOREA
(Inside the city wall.)

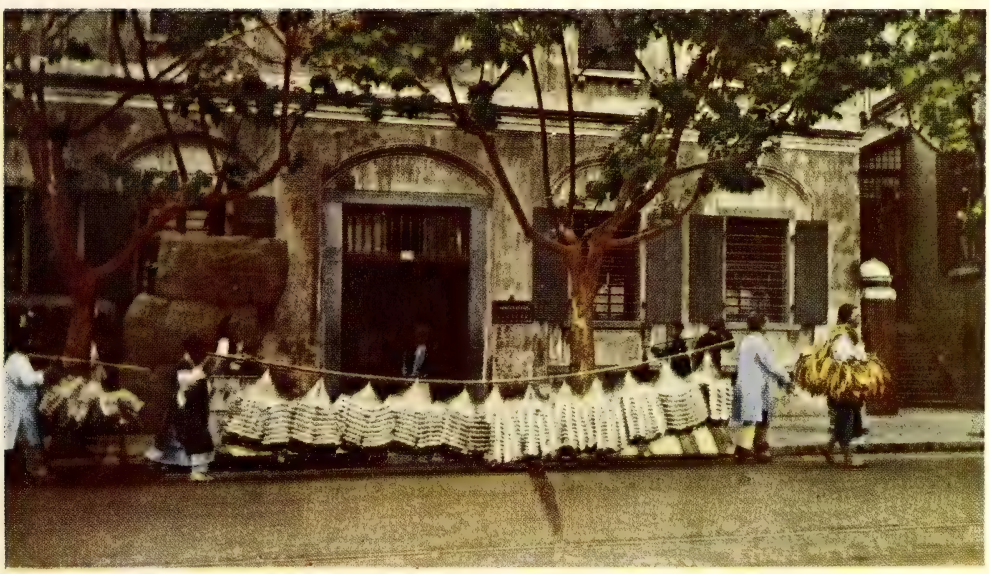
KOREAN GENTLEMAN: SEOUL, KOREA
(Bargaining for pottery.)

ONE OF THE GATES OF SHANHAIKWAN: CHINA
(A corner of the city inside the wall.)

PRISONER WEARING CANGUE OR BOARD COLLAR:
SHANHAIKWAN, CHINA

CHINESE PRISONERS
(Exhibited on the street before being liberated.)

A BACK STREET: PEKING, CHINA



SYCHEE, PAPER SACRIFICE: CHINA
(Paper scrip for sacrifice in the temples.)

ENTRANCE TO CITY OF THE DEAD: CANTON, CHINA

MARBLE MANDARIN: CHINA
(One of the marble figures on road near Ming Tombs. Guide Chin on donkey.)

THE MANCHU FAMILY AIRING: PEKING, CHINA

MONGOLIAN CARAVAN: NANKOU PASS, CHINA

"PUZZLE PICTURE," NEAR MING TOMBS: CHINA
(How many passengers are being carried?)

MANCHU WOMEN: PEKING, CHINA
(Crossing road to dodge the kodak.)

CHINESE HIGH-CLASS FUNERAL: PEKING

WEDDING CHAIR OF GROOM: PEKING, CHINA

MANCHU WOMEN: PEKING, CHINA

pounded the wet garments placed on smooth stones. On one of these occasions, in the same stream a short distance from this jolly crowd, were others rinsing and trimming cabbages and other vegetables, preparing them for market. On the same sewer, a little farther on, was a poultry market, with numbers of crates of fowls, close to the water. We wondered how clothes could be made so white under such conditions.

The religious uplift of Korea has been almost phenomenal. Based on the latest reports of the results of missionary efforts, comparatively speaking, it leads the world. If the Christian workers whom it was our good fortune to meet in this field are indicative of the devotion and aggressiveness of the others, and if they are aided in the future by the more liberal support of Christians, which the past success of the work warrants, it seems reasonable to expect the wonderful results begun will continue beyond all precedence.

At the service which we attended in the Methodist Episcopal Church the edifice was filled to the doors. On one side of the center aisle sat the men in white, all wearing the peculiar little hats; the opposite side was occupied by women with heads uncovered, many of them gowned in different shades of green, with red waists or jackets. The space in front and at each side of the preacher, extending about ten feet, was filled with children, sitting on the floor. During the prayers the women turned in their seats and knelt.

In this church the curtain, which for years hung in the center aisle to shield the women from the scrutiny of the men, had been removed at their suggestion two years before. The pastor, a native, distantly related to the royal family, is said to be a very talented and forceful preacher.

A visit to the imperial palace, although unoccupied, was interesting. The buildings and grounds are extensive; a handsome pagoda standing on a small island is surrounded by a lotus pond, a wealth of trees adding to the beauty of the place. During the reign of the old emperor, his fear of assassination was so great that it is said 300 bed-rooms in the palace were kept constantly in readiness for him, no one knowing which one he would occupy on any night.

One of the most enjoyable trips from Seoul is by rickshaw past the Peking or Independent Gate through a picturesque road winding among the mountains. The construction of the great wall of Korea at this point appears a marvel of engineering skill, so seemingly inaccessible is this mountain fastness. Proceeding about two miles, we pass the water-gate, where the wall crosses the river and where in time of attack the iron gates in these great arches were let down to protect the city. The view of this crossing is one of the finest in Korea.

Another ride of three miles brings us to the White Buddha. In the solitude of this wilderness, far from the highway, close beside a clear mountain stream, stands a great granite boulder, on the face of which, carved in relief, is the sitting figure of Buddha. Above is a curved roof of the pagoda style, with elaborately carved cornice decorated in high colors. Every three years the outlines of the idol are given a coat of white paint, with a delicate moustache, ears, etc., in red to give it character. In front of the idol was a little shrine on which stood a lantern.

Enterprising shop-keepers in Seoul evinced their desire for English trade by signs, some of which were full of detail: "Handkerchief special occupation," "Copper, iron, lead and repaired store," "Broker for several kinds of manure," "Wild silk," "Cow meat," "Firm and without fade at bedyed for many colors," are self-explanatory.

Over a drugstore was, "Every medicine is required for small or wholesale," followed by the assurance that "all kinds of sickness must be examined or cured," while hanging in the window of a vacant building was the announcement, "To sell apply within next door."

The raincoat used by the Korean peasant and farmer is in shape a long cloak

BLIND STREET MUSICIANS: PEKING, CHINA

fastened around the neck, and is made of long straw, one layer overhanging another similar to a thatched roof, and is only effective when the wearer stands erect under the broad-brimmed hat.

The poultry peddler is a familiar object on the streets of this city, bearing his load of cackling merchandise in a cage on his back—a method of vending, to our minds, far more reassuring to the purchaser than holds among the Chinese, where dressed fowls are offered for sale, prepared by some process giving them the appearance of having fainted, so sickly white do they look.

The assassination of the beloved Queen of Korea by a Japanese in 1895 was an act which stirred this old sleepy nation to its foundation. Although her body was burned to conceal the crime, a small bone was recovered, for which a suitable place of interment had to be found. After the selection of several locations, upon one of which considerable labor was expended, all were abandoned for astrological objections. The astrologers, however, favored another spot, and, although this happened to be already occupied by a village, at great expense 1,000 acres were cleared of habitations, trees planted, an artificial hill 50 feet in height raised, and the small portion of her remains here buried in state. This assassination was one of the causes incident to the intense feeling of resentment which the Japanese met in their efforts to subjugate Korea.

How rapidly have events vital to Korea succeeded each other since the death of her Queen, in 1895 — the Chinese-Japanese and Russo-Japanese wars, followed by the assassination of Marquis Ito and other Japanese officials by Koreans, all tending toward the final extinction of this little nation as such. It is still a matter of considerable doubt as to the extent of benefit the change will prove. So far as revealed, Japan's intentions seem satisfactory to the powers and ultimately to the advantage of the people of the Mikado's new province, Cho-Sen.

CHINA

If a very high estimation be placed on Korea in point of unusual pictorial subjects, China's vast area of 43 times that of its little neighbor ranks still higher in the variety of its scenery, being a veritable paradise for kodakers. Although in certain localities there is some personal objection to being included in pictures, owing to superstition as to the

HAULING AN IMMENSE LOG

power of the evil eye with which the lens of the instrument is associated, it is but trivial.

Probably no part of the Dragon Empire can furnish such a stream of entertaining subjects as the great city of Peking, for on its site there has been a city 3,000 years, and it has been the seat of government since 1282. The present population is estimated at 1,500,000, and, although its massive wall 50 feet high describes a circumference of but 25 miles, the thickly populated suburbs close to the enclosure are fully as attractive.

Of all subjects we attempted to openly kodak in the city of Peking, the dainty, shy Manchu women were the most difficult. Naturally retiring, they seemed instinctively conscious of the presence of the camera, as a crow is said to smell the powder of the hunter, and so exhibited their timidity by running like a rabbit, dodging into doorways, where they would stay until the danger was passed. One would scarcely think they would object to a foreigner conveying their picture to their sisters on the opposite side of the globe, since they had spent so much time in arranging their hair on the peculiar-shaped thin boards, liberally applying cosmetic and vermilion on their faces and arraying themselves in their handsome gowns.

The mode of travel to the interior of China is on the back of a donkey or in the springless mandarin or Pekingese cart drawn by the same animal. During the trip to the Ming Tombs the snapshot was made which resulted in taking what proves to be a puzzle picture (see page 924). The umbrella was held low to prevent our taking the faces of the passengers, for if examined carefully a second person may be seen holding the umbrella.

One of the cheaper conveyances in Peking is the open Pekingese cart. It has a canvas covering extending from over the donkey's head to the back end of the vehicle. The most elaborate feature of the outfit is the fellies of the wheels, which are embellished with three rows of ornamental headed nails, giving the appearance of great strength. Although the jolting propensity makes these wagons most uncomfortable, nevertheless they are very popular and are frequently so filled with people that there is standing room only.

Peking is the Mecca toward which weary, burdened caravans wend their

A STEAM ROLLER IN THE AMERICAN SETTLEMENT AT SHANGHAI

way from distant boundaries of Mongolia, scores of them daily exchanging their valuable cargoes of the products of those lands for teas and other supplies.

The tired, dust-begrimed beasts in these trains seen entering the great city gates are not the gaily caparisoned, well-fed camels of the circus street-parade common to America. Owing to the exhausting heat of the sun, many of these caravans travel by night, the animals being relieved of their burdens in the morning for a few hours' rest, until the line of march is resumed at nightfall.

The occupation of mendicant street musician appears to be monopolized by the blind. From the sounds they produced on their strange, discordant instruments, we thought it would be much to their own advantage to be deaf also. The poor creatures were very numerous; while occasionally seen singly, they were more frequently met in twos or threes.

The method of street sprinkling in Peking is quite novel. A tub containing about one-half a barrel of water is carried by means of a pole run through the handle on either side. Two men carry this from the street-pump to the part of the road to be sprinkled. The pole is removed and one of the men, with the aid of a long-handled dipper, throws the water broadcast. This is an instance where "Chinese cheap labor" works in very advantageously.

Nothing in China will bear comparison, however, with what is known as the Great Wall. The very ancient city and provincial walls were connected more than 2,100 years ago. As an example of engineering skill, where is its equal? Its course, beginning in the sea, reaches an altitude of 10,000 feet, skirting the highest mountains and crossing the most inaccessible gorges. Considering it as a war measure, it is the most gigantic defensive work in the world. In extent it covers a length, according to recent investigations, of 2,550 miles. These facts alone would establish its claim to being classed near the top of the list of world wonders, without mentioning the wall as being the longest cemetery on earth, owing to the great mortality attending its construction, when the practice prevailed of burying the dead in the filled space between its outside retaining walls. Then we must not lose sight of the

STREET SPRINKLING: PEKING, CHINA (SEE PAGE 930)

claim some scientists have made that this serpent-like structure is the only object on the earth's surface which can be distinguished by our distant neighbors on the planet Mars.

Mr. Toole's account of the Great Wall, while humorous, contains some historical facts. He says: "The most important building in China is the Great Wall, built to keep the Tartars out. It was built at such enormous expense that the Chinese never got over it, but the Tartars did. The way they accomplished the feat was 'One went first and t'others went arter.'"

Wedding processions, always interesting in every land, are quite spectacular in China, and, like funeral pageants, are preceded by music, if the sounds produced by the pipers can be so termed. In the street procession the groom appears to have no part, his chair, borne by eight coolies, forming an independent parade.

The variety and splendor of funeral processions is one of the features of Peking. There is a Chinese proverb which reads, "The most important thing in life is to be buried well." If this implies being placed well underground, the conditions are not generally carried out, for in no country, according to our observation, were so many half-buried coffins seen as here; but if the reference is to pomp and extravagance, could the deceased have seen the displays it was our privilege to view they would have crawled back to their caskets to resume their long sleep with the consciousness that the purpose of their lives had been most satisfactorily achieved.

The city of the dead in Canton, South China, has storage capacity for 500 caskets. This silent city is made up of a great number of small one-story stone buildings, each house having two rooms of about 8 by 16 feet in size. A cumbrous coffin with the name of the deceased inscribed in Chinese characters on the foot occupies each room. The only other object in the room is a small shrine near the entrance, upon which light refreshments are placed. Here, amid the fragrance of smouldering incense, the spirit of the departed may daily enjoy a quiet cup of tea and a small cake, provided that surviving relatives continue to pay the expense.

THE GREAT WALL OF CHINA, WHICH DEFENDED THE NORTHERN FRONTIER OF CHINA FOR A DISTANCE ALMOST AS FAR AS FROM NEW YORK TO SAN FRANCISCO

THE GREAT WALL OF CHINA: UP ON THE MOUNTAINS

Some of the caskets in these receptacles were elegantly finished in highly polished lacquer and cost $1,000 each. The object of leaving the remains in this place is to insure the happiness of the one of the three spirits of the deceased supposed to remain in the bones by providing for it food, drink, and shelter.

One of the peculiar beliefs regarding the dead is that, if the soul of the deceased does not rest comfortably, the relatives will be correspondingly unhappy. The expense of storage and attendance often becomes very burdensome. We were told of an instance where the cost for the storage of the remains of a woman had used up the entire property of her husband, and that then the former servants of the family had voluntarily come forward and were then defraying the entire expense.

One of the minor penalties inflicted on a person convicted of crime is to lock the cangue, or board collar, on his neck, which he is sometimes compelled to wear several months. This implement of torture is constructed of boards 3 inches in thickness and 3 feet square, weighing from 30 to 100 pounds. In certain cases the culprit is chained on the street, and, with his offense written upon the cangue, is exposed daily to the view of passers-by. The victim is dependent on his friends, owing to the width of the collar, which prevents him from feeding himself.

While in the city of Shanhaikwan, and wishing to obtain a picture of one of these unfortunates, a prison was visited in company with an interpreter. The amount the jailer required for producing a prisoner wearing the collar seemed a little excessive. But when, according to the habit acquired in the shops of the country, an offer of one-half the price asked was made, the subject was at once forthcoming. The background of the picture includes the rack holding the staves for use in administering the punishment decreed by the magistrate, or for forcing a confession from an accused prisoner.

In some parts of China it is the custom to exhibit through the streets prisoners who have paid the penalty of their crimes and are about to be released. This permits the people to become familiar with their faces, so as to recognize them thereafter. In the case of serious offenses, one of the first acts of punishment administered to convicts is cutting off the queue, considered a mark of deep disgrace.

So unique are the methods of this old empire in the administration of justice that the entire subject is one of deep interest; for where the world over is such a vast population kept in orderly control by the minimum police and military force?

A tourist, when visiting Northern China, does not feel he has lived up to his opportunities if he neglects to visit the "Ming Tombs." The Ming rulers were the last strictly Chinese dynasty, which terminated about 500 years ago, when overthrown by the Manchus.

The burial place of these monarchs is located about 50 miles from Peking and 7 miles from Nankou. The only means of transportation from the latter place to the site is on the backs of the frisky donkeys or in sedan chairs.

The monotony of the several miles' ride by this slow manner of locomotion through the plains begins to tell on one when, as if to dispute the way, there loom up ahead an avenue of ghostly figures. On approaching, these are seen to be great stones which have taken on the forms of mammoth mandarins, lions, elephants, camels, unicorns, etc., to the number of 48, and stand on either side of the path about 300 feet apart. The effect of meeting these silent figures, which seem to gaze on one as he proceeds through the solitude of the lonely place, is quite impressive.

The accounts that travelers and writers give of conditions and experiences within this vast empire sometimes seem very conflicting. However, customs are so radically different in the several provinces that only a short visit is necessary to convince one of the probable truthfulness of the statements, as well as the fact that the half has not yet been told of this people, so wonderful, so ancient, and so unique.

A NEW SOURCE OF POWER

Billions of Tons of Lignite, Previously Thought Too Poor Coal for Commercial Use, Are Made Easily Available

By Guy Elliott Mitchell

Author of "Our Greatest Plant Food," "Our Coal Lands," Etc.

LIGNITE is a low grade of coal—the lowest and poorest in heat units, and only a step removed from peat and wood. The government coal geologists estimate that the deposits of this fuel in the United States exclusive of Alaska aggregate about 740 billion tons (740,000,000,000), of which fully one-third belongs to the public lands.

A few years ago it was not considered important whether there was much or little of this coal. It was good enough, perhaps, for the farmers to dig out a few loads and burn in their homes throughout the Great Plains region, where it is found; but it contained too few heat-units and too much moisture to generate steam under a boiler, so it was looked upon as of no industrial importance whatever.

Moreover, it would not bear transportation well, since it air-slacked and crumbled. A large part of the waving wheatfields of North Dakota were known to be underlain with lignite, but it was too young geologically, too poor in fixed carbon, to be of any great material use to the State or the Nation. Subjected to volcanic or other great earth pressures, or aged a couple of million years, it might become a second Pocahontas coal and attain great value commercially.

But the value of a thing is often a mere matter of knowledge concerning it. The Saint Louis World's Fair came along, an exposition of the products of the great territory acquired from Napoleon, and it was fitting that as a result the lignites of the Dakotas and Montana, parts of that wise purchase, should be demonstrated to have an incalculable potential value.

BY WHICH LIGNITE RIVALS OUR BEST COALS

The present director of the new Bureau of Mines, Dr Joseph A. Holmes, suggested the establishment of a government fuel-testing plant at the Saint Louis Exposition, under the Geological Survey, and one of the most important and far-reaching discoveries of the tests was that lignite, the useless, the despised, would do more actual work, turn more wheels of industry, ton for ton, if burned in a gas producer, than the highest grade, highest priced Pennsylvania or West Virginia coal fed into the best steam engine in existence.

The results of these tests are among the most remarkable of an age replete in wonders of discovery and invention. North Dakotans need not wait two million years nor pray for a volcanic convulsion to transform their lignite into coal; the lignite today has an industrial value which may yet turn many billowy grain fields into thriving manufacturing centers.

Plainly stated, these Geological Survey fuel tests showed that when coal is made into producer-gas and then used in a gas engine it has from two to three times the efficiency or driving power that it has when burned under a steam boiler in the ordinary way. The high-grade coals, too, were found to possess a greater efficiency when used in a gas engine, but the spectacular feature of the experiments was that vast stores of

AN 8-FOOT LIGNITE SEAM, NEAR GLENDIVE, MONTANA

lignite, which are entirely useless for steaming purposes and had previously been considered practically worthless, can be used most successfully in the gas producer.

REMARKABLE WORK OF THE GAS ENGINE

Prof. Robert H. Fernald, late in charge of the producer-gas tests of the Geological Survey, made an estimate of the cost and operation of a small gas engine in comparison with that of a steam engine of the same horse-power, and also of two large engines, gas and steam, of the same horse-power. The figures are impressive. Professor Fernald gives the cost of a 600-horse-power gas plant at $48,000 and the steam plant at $40,000—$8,000 in favor of the steam plant. Operating both plants 300 days, 24 hours a day, the total cost for coal in the gas plant would be $3,680; in the steam plant, $8,250.

In a large plant, however, of 6,000 horse-power, he found no difference in cost between steam and gas plants. But, running these two plants continuously for one year, the gas plant would require but 21,000 tons of coal, which, at say $2.50 a ton, would be $52,500, while the steam plant would consume 42,000 tons of coal, at a cost of $105,000. The total operating expense and fixed charges of the 6,000-horse-power gas-producer plant are given at $141,775, while those of the 6,000-horse-power steam plant would cost $219,535—an annual saving of $77,580.

In offering the estimates, Professor Fernald declares that he has made the best possible showing for the steam engine, while that of the producer-gas plant is but a fair figure. In conclusion, he adds: "I believe that the producer-gas plant can better the figure given, but I doubt very much whether the steam-plant figure can be excelled, even if it can be reached."

Surely such savings of cost as these must appeal to the big manufacturers. That they do is shown by the fact that certain types of steam engines exhibited

A 9-FOOT LIGNITE SEAM, NEAR WILLISTON, NORTH DAKOTA

at the Saint Louis Fair as the very acme of steam-engine construction have since then been thrown onto the junk-heap and gas-producer plants substituted.

PRODUCER-GAS *vs.* STEAM PLANTS

In one of Professor Fernald's reports* a large number of most interesting comparisons are given, showing the relative efficiency of steam and gas plants in converting various grades of coal into electrical energy. Thus, of an Illinois coal from Springfield, it required 5.27 pounds to develop 1 horse-power in the steam plant as against only 1.79 pounds in the gas plant. Of an Indiana (Terre Haute) coal, it required 4.52 pounds in the steam plant against 1.61 pounds in the gas plant to develop 1 horse-power.

Most notable, however, were the results in the low-grade coals and lignites. Of a North Dakota lignite from Lehigh, 10 pounds were required in the steam plant to develop 1 horse-power, and only 2.82 pounds in the gas plant. With other lignites from Williston, North Dakota, Red Lodge, Montana, as well as several Texas lignites which proved absolutely worthless under the steam boiler, from 2½ to 3½ pounds developed 1 horse-power in the gas producer. Of 75 comparative tests made by the Geological Survey, the coals, when used in the gas plant, had from 2½ to 3½ times the driving power that they had in the steam plant.

In these tests the North Dakota and Texas lignites, and even Florida peat, yielded more power than did the very best Pennsylvania and West Virginia coals under the steam boiler.

HIGH VALUE OF THE LIGNITES

Commenting on the value of these tests, with special reference to the Dakota and Texas lignites, Professor Fernald remarks:

* Bulletin 416, United States Geological Survey, can be had upon application.

SEVEN FEET OF SOLID LIGNITE IN THE YELLOWSTONE RIVER BLUFFS, NEAR SIDNEY, MONTANA

"It should be noted that many fuels which give poor results under steam boilers have been used with great ease and efficiency in the gas producer, which thus makes it possible to utilize low-grade coals and lignites that have heretofore been regarded as practically useless. Several of the poorest grades of bituminous coals have shown remarkable efficiency in the gas producer, and lignites and peat have been used in it with great facility, thus opening the way to the introduction of cheap power in large districts that have thus far been commercially unimportant, owing to lack of industrial opportunities."

Although the gas producer is quite a new institution, the possibilities of this form of power and its ultimate future is indicated by the fact that there are already in the United States between 150 and 200 gas-producer installations, ranging in size from 1,500 to 9,000 horse-power.

The latest and perhaps most interesting phase of the development is the conversion into producer gas of the waste from blast furnaces. At the Gary steel plant, in Indiana, where the great blast furnaces run night and day, the fumes and waste which would otherwise belch from the huge chimneys to pollute the atmosphere are captured and converted into producer gas to the extent of creating 100,000 horse-power. This suggests the fact that with the producer-gas plant there is no smoke nuisance. The poorest, smokiest, smudgiest coal may be used, but there will be no smoke, because there are no smokestacks. The gas is generated in a producer which has no chimney and needs none. The coal is turned directly into gas, which goes straight to the engine.

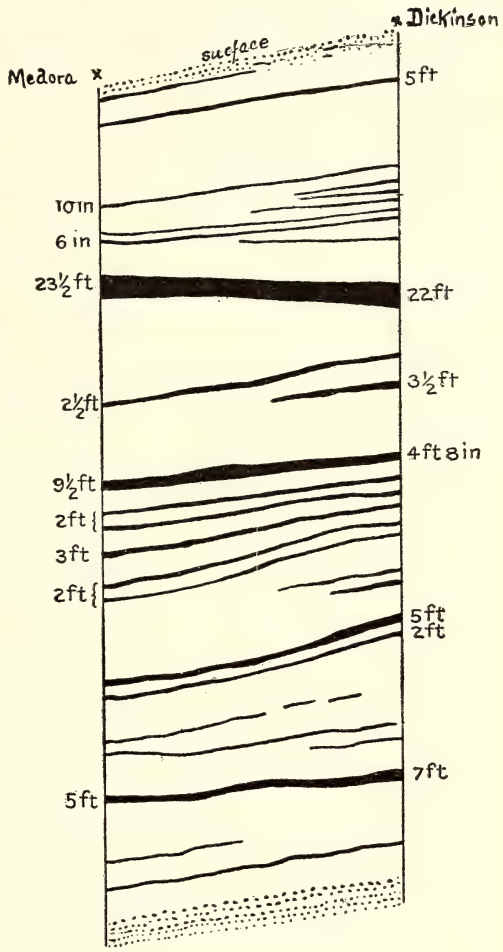
THE PASSING OF THE STEAM ENGINE

Really it seems as though we had come to the passing of the steam engine, the maker of civilization, and that the gas engine, the toy of yesterday, has loomed upon the industrial horizon and grown over-night into the giant of today. Its appearance means not only an eventual saving in the country's coal bill variously estimated at from $100,000,000 to $200,000,000 annually, but certainly a wider distribution of industrial enterprises.

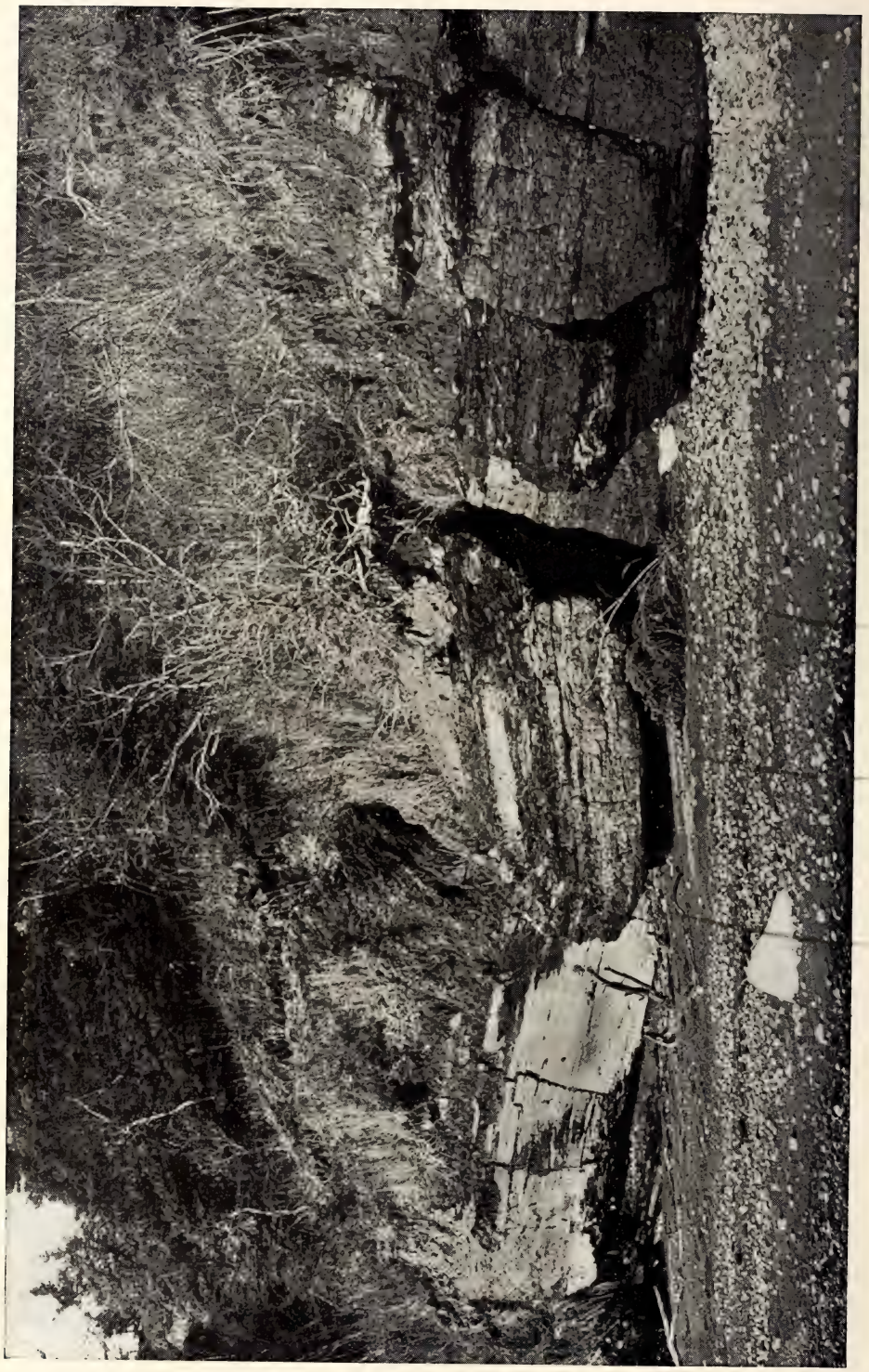
The great reduction in the cost of power production, made possible by the use of the gas producer, Professor Fernald says, means also rapid strides in electrical development within the next few years. Now that it is commercially possible to transmit electrical power for distances of 250 miles or more, the location of immense power plants using producer gas will speedily follow. A central plant could distribute such electric current for a distance of 500 miles; that is, 250 miles in all directions from the plant, thus covering a territory of probably 200,000 square miles—an area nearly four times the size of Illinois. With ten or a dozen of these great central plants located at the various coal-mining centers, the great railroads of the United States could send their trains speeding from the Atlantic to the Pacific Coast.

It would seem ridiculous to predict the immediate doom of the steam locomotive, Professor Fernald says; yet one of the officials of the New York Central Railroad has publicly stated that within 10 years, in his opinion, there will be no steam locomotives operating on the New York Central road. Already the New York Central has substituted electric for steam power on its lines from New York city to a point about 40 miles from the Grand Central Station, and it is rumored that before long electric trains will be running regularly on this road from New York to Buffalo.

These rapid changes are leading to one end—the centralization of power development and distribution. They point to the time, and at no distant day, Professor Fernald believes, when great central plants will be located at mine centers, and the electric power will be transmitted and distributed to railroads, industrial plants, cities, and the various institutions where electrical energy is needed. The great railroads will operate their trains by electricity, passengers and the country-side will be freed from the annoyance of smoke and cinders, while disastrous forest fires caused by sparks from locomotives will become a thing of the past.



An aggregate of 50 feet of Lignite Strata, lying between Dickinson and Medora, North Dakota, a distance of 40 miles.



A GOOD LIGNITE OUTCROP NEAR TYONEK, ALASKA

A LIGNITE LEDGE: KENAI PENINSULAR COAL-FIELD, ALASKA

ASTONISHING WASTE OF ENERGY IN STEAM PLANTS

From the standpoint of conservation, the producer-gas experiments and the rapidly increasing installations of gas-producing plants are notable advances. Stated in terms of wasted energy, the figures of fuel consumption become deeply impressive.

Incredible as it may seem, the fuel consumed in the ordinary manufacturing plant operated by steam power yields less than 5 per cent of its available energy in useful work; the other 95 per cent is wasted. The superintendent of motive power of the New York subway system, one of the most efficient steam plants in existence today, estimates the total losses in a year's operation of the plant at about 90 per cent—the utilized energy at only 10 per cent. As against this, it is estimated that a producer-gas plant operated on a similar scale would utilize over 21 per cent of the available energy in the fuel consumed.

Not only will the ultimate complete substitution in the United States of the gas engine entail a direct saving of millions of tons of coal annually, but, through the utilization of the lower-grade coals and lignites, which would otherwise never be mined, it will greatly lengthen the life of the high-grade coal deposits.

LIGNITE BRIQUETS

Another feature of interest in connection with the utilization of lignite is the briquetting tests started under the Geological Survey and now being carried on by the Bureau of Mines. Briquets from dust of ordinary coal make almost ideal fuel, but they are expensive to produce. The several per cent of "binder"—tar, pitch, etc.—necessary to make them cohesive runs up the cost. Lignite, however, can be briquetted without binding material; at least, this is done with some of the foreign lignites, and there seems no reason why American lignite as well should not make good briquets. The lig-

ALASKA LIGNITE COAL, EXPOSED FOR THREE YEARS TO WEATHERING AND SHOWING RESISTANCE

nite briquet machine which is being used in the government tests is a huge affair and simply exerts enormous pressure on the lignite, the constituency of which is such that a solid, dense briquet is formed, which makes an admirable fuel. Lignite, converted into cheap briquets, will keep indefinitely and bear transportation. The gas producer has made lignite a great possibility in industrial development; the briquetting machine promises to raise it into the class of a highly valuable domestic and heating fuel.

ENORMOUS LIGNITE AREAS AND TONNAGE

While the older coal fields of the Appalachian region may for some time lead in production, the advent and the continued improvement of the gas producer capable of utilizing the lower-grade fuels will have an important bearing on the distribution of industrial activities. With this feature in mind it will be of interest to inquire into the extent of these little-known lignite coals.

The latest field investigations of the United States Geological Survey show that North Dakota has an area of 31,240 square miles—19,993,600 acres—underlain with lignite. In much of the field there are several beds or seams, sometimes a dozen, one below the other. The tonnage of the State is placed at the stupendous total of 500,000,000,000 tons. As compared with this, the total tonnage estimated for the great coal fields of Pennsylvania, both anthracite and bituminous, is 112,500,000,000, and the importance of the advent of the gas producer is recognized when it is realized that every ton of the North Dakota coal has more driving power, utilized in the gas engine, than a ton of the very best of the Pennsylvania coal used in steam plants.

Montana will be a rich field for the gas plant, since she has an estimated 300,000,000,000 tonnage of lignite and low-grade bituminous coal, as well as some high-grade coal. In the San Juan field of New Mexico the Survey geologists estimate over 130,000,000,000 tons

of subbituminous coal, a grade above lignite and probably of little use for steaming purposes, but efficient in the gas producer. Texas has 23,000,000,000 tons of lignite, utterly worthless, according to the Survey tests, except in a gas plant, where it develops more energy than West Virginia's highest-grade coal. Even Louisiana and Mississippi, which are surely never thought of as coal States, have an area of over 16,000 square miles underlain with lignites. In considering some of these large coal areas, it is something of a shock to find that the great "coal trust," which owns the entire anthracite field in Pennsylvania, has only 480 square miles of coal land. On the coal map issued by the Geological Survey, this hard-coal field appears as an infinitesimal patch.

Summarizing the Geological Survey figures, the total area in the United States underlain by lignite and subbituminous coal—coal mostly of little if any value in steam plants, but of great efficiency in gas producers — is 246,245 square miles, or over 150,000,000 acres, and its tonnage is 1,393,423,000,000 short tons.

The tonnage of the lignite is calculated on the basis of about 1,800 tons per acre, one foot deep. Thus, if an acre is underlain with, say, two 4-foot seams, it will contain 14,400 tons of lignite. A square mile would contain 9,216,000 tons. In the tonnage estimates of the lignite fields, under the regulations of the Interior Department no account is taken of the deposits below 1,000 feet. If the estimates included the lignite found down to the 3,000-foot depth, as they do in the higher-grade coal, the tonnage would be immeasurably increased. It is interesting to note, in this connection, that the deepest mine in the world—in Belgium—in which coal is mined, approximately 4,000 feet below surface, is a lignite mine.

ALASKA'S LARGE LIGNITE DEPOSITS

Mention of Alaska's lignite deposits should not be omitted. About one-half of the Territory's coal is believed to be lignite, and, while there is not sufficient information upon which to base even an approximate estimate of the total tonnage of the various fields, it is probable that the reserve of lignite may be 500,000,000,000 or more tons.

To better comprehend the extent of this new resource, discovered in fact through the gas producer, the amount of coal already mined in the United States may be compared with the estimated reserves. Since mining first began the total amount of coal produced and the amount wasted in mining has been, to January 1, 1910, approximately 12,000,000,000 tons, which is a little more than one-half of what yet remains underground in the little 480 square miles of the anthracite field. The 1909 production was about 450,000,000 tons, with perhaps a recovery of 60 per cent—40 per cent being lost in mining—or a total exhaustion of 750,000,000 tons last year. This is just fifteen-hundredths of one per cent of North Dakota's easily accessible lignite.

VALUE OF PEAT

The improvement of the gas-producer plant has also brought into the field another natural resource heretofore considered of little if any fuel value, namely, peat. The knowledge of the area and tonnage of our peat deposits is incomplete; but they are very great, both in the United States and Alaska.

It is significant, too, that the regions in the United States that have peat beds of workable size and depth are found to lie almost entirely outside the territory in which the coal fields and supplies of other natural fuels are known to exist in abundance. The Geological Survey's estimate of twelve billion (12,000,000,000) tons of air-dry fuel as the product of the peat beds of the country, exclusive of Alaska, is believed to be an ultra-conservative one. Peat beds occur throughout Minnesota, Wisconsin, Michigan, New York, New England, New Jersey, Florida, in the eastern part of the Dakotas, barely infringing upon the lignite beds; northern Iowa, Illinois, Indiana, Ohio, Pennsylvania, Virginia,

North Carolina, South Carolina, and Georgia, and along the Pacific coast.

In Alaska no attempt has been made to estimate either the acreage or tonnage of peat. Professor Davis, the author of several Geological Survey reports on peat, states that the conditions throughout the greater part of Alaska favor the formation of peat, and he makes mention of many beds in the southern part of the Territory having a thickness of 15 or 20 feet. In the northern portion he speaks of peat beds 8 and 10 feet, and of others 30 and 40 feet deep which have been exposed by natural agencies. It seems evident, he says, that peat beds of workable extent are to be found in most parts of Alaska.

As a fuel for the making of producer gas, peat has an important place. In a country so marvelously endowed with wood, coal, petroleum, and natural gas, it has been assumed that peat has no place as a fuel, except in the far-distant future. However, inasmuch as transportation charges enter largely into the ultimate cost of fuels, and since peat is found in regions remote from other fuel supplies, it is coming to be recognized that its utilization may mean the establishment of manufacturing industries in many parts of the country at a distance from coal centers.

Like coal, peat varies in quality; but, of the tests made, some of it has been found the equal and even the superior of certain of the lignite coals, while in the gas producer it has developed more horse-power than the highest-grade coal in steam plants, ton per ton. Its theoretical heating value is between that of good wood and good coal. It carries from five-eighths to five-ninths the calorific value of the best bituminous coal.

KBOO, A LIBERIAN GAME

By G. N. Collins

OF THE multitude of intellectual games in vogue among civilized people, chess and draughts can alone be classed as games of pure skill, entirely free from chance. These are both supposed to have come to us from southern Asia.

A third game, equally free from chance, and, like chess, affording unlimited opportunity for the exercise of mental skill, is played over the whole of Africa and southern Asia, and by the negroes of the West Indies, but seems never to have been taken up by European races.

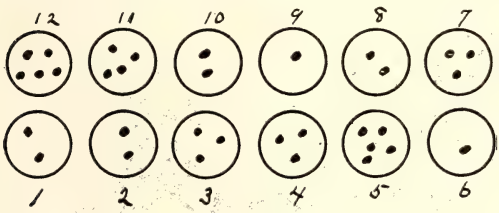
The game is most widely known by its Syrian name, *mancala.* A form of this, called *kboo,* or *boo,* is the only game of skill played by the Golah people of Liberia. Kboo is purely arithmetical, and it seems remarkable that natives who are unable to even give names to the numerals above 30 can excel in the intricate mental calculations of this game. The same man who was able to plan and execute a long series of complicated moves in this game would calculate the price for whip-sawing lumber by measuring only the width of the boards, disregarding their length.

The game as played by the natives of Liberia consists of a boat-shaped board (see figure on page 945), with 12 cup-shaped depressions arranged in two parallel rows of 6 each. The board in the writer's possession is made of some heavy dark wood, colored black and highly polished. The counters, or "men," are seeds of a leguminous plant, and are about the size of small kidney-beans.

The two players sit with the board placed crosswise between them, one row of holes being guarded by each player. At the beginning of the game each hole contains four seeds. To begin the play, one of the players takes all the seeds from any one of the holes on his side and drops one in each of the succeeding holes around the board, playing from

left to right, or counter-clockwise. His opponent does likewise, playing from any hole on his side. As soon as play commences, some holes are of course left empty and others receive more than the four seeds. In subsequent plays these empty holes will again receive one or more seeds.

One of the objects of the game is to play from such a hole that the last seed will fall in one of the holes on the opponent's side which contains either one or two seeds. When this occurs, the seeds in this hole, together with the seed dropped, are removed and count in favor of the player making the play. If any holes immediately preceding that from which such a "catch" is made contain one or two seeds, the whole series are also removed until a hole is reached that was either empty or contained more than two seeds. This play can be best explained by the following diagram:



If the player guarding the lower row of holes elects to play from hole number 5, the first of the five seeds would fall in hole number 6, the next in 7, and the last in 10. Since hole 10 contained two seeds, the three which it would contain after the play would be "caught," as well as the two in 9 and the three in number 8. The seeds in 7 would be safe, since they are more than two. Seeds can only be caught from an opponent's side.

The play continues until there are no seeds left on one or the other side when it is that player's turn to play. The game is then finished and all seeds remaining on the board count for the player on whose side they remain, and are added to those already caught. The player having the most seeds wins the game.

With skilled players the seeds caught during the game seldom play an important part, the principal effort being di-

THE BOAT-SHAPED BOARD USED IN THE LIBERIAN GAME KBOO
This game in slightly different forms is played over all Africa

Photo by G. N. Collins

Photo by G. N. Collins

GOLAH MEN PLAYING KBOO

Photo by G. N. Collins

GOLAH "HEADMAN," A SKILLFUL KBOO PLAYER AND AN INVETERATE GAMBLER

rected toward manipulating the play so that the seeds are accumulated on one side, leaving the other player with none. An important factor is the ability to properly estimate an opponent's skill; an elaborately planned campaign may be entirely frustrated by unexpected stupidity on the part of an opponent, as well as by superior skill.

The illustration on page 946 shows two natives playing this favorite game. The posture, which would be so uncomfortable to any European, is characteristic and perfectly comfortable for these natives.

On first acquaintance this game may seem childish, but as soon as a few games have been played the possibilities of strategy, feint, and decoy become apparent and the game will be found intensely interesting. The principle is entirely different from that of either draughts or chess, both of which depend on space relations, while kboo is entirely arithmetical. Although different forms of this game have been frequently described in technical publications,* no serious effort seems ever to have been made to introduce this African game among European people.

The Golah "headman," whose picture is shown on page 947, was the most skillful player I ever met. The long rainy season of Liberia afforded ample opportunity for practice, but as fast as the moves of my Golah adversary were mastered he inaugurated new methods, before which I was equally helpless.

* Lane, E. W.: Manners and Customs of the Modern Egyptians, p. 315.
Culin, S.: Mancala, The National Game of Africa. Report U. S. Nat. Mus. for 1894 (1896), p. 597.
Avelot, R.: Bull. Soc. d'Anth., Paris, 1906, pp. 267-271, and 1908, pp. 9-21.
Golberry: Fragment d'un voyage en Afrique. Paris, 1791, Vol. II, p. 480.

THE PEST OF ENGLISH SPARROWS*

By N. Dearborn

THE English sparrow among birds is comparable to the rat among mammals. It is cunning, destructive, and filthy. This sparrow was introduced into America about 60 years ago, and is now distributed generally over the eastern half of the United States and southern Canada and locally westward to the Pacific coast. This rapid increase is a result of the bird's hardiness, extraordinary fecundity, diversity of food, aggressive disposition, and almost complete immunity from natural enemies through its sagacity and its preference for thickly settled communities.

Its natural diet consists of seeds, but it eats a great variety of other foods. While much of its annual fare consists of waste material from the streets, in autumn and winter it consumes quantities of weed seed, and in summer numerous insects. Aside from the destruction of weed seed, there is very little to be said in the sparrow's favor.

It destroys small fruits, as cherries, grapes, pears, and peaches. It also destroys buds and flowers of cultivated trees, shrubs, and vines. In the garden it eats seeds as they ripen, and nips off tender young vegetables as they appear above ground, peas and lettuce being especially subject to attack. It damages wheat and other grains when newly sowed, ripening, and in shocks. It reduces the numbers of some of our most useful native species, such as bluebirds, house wrens, purple martins, tree swallows, cliff swallows, and barn swallows, by destroying the eggs and young and by usurping the nesting places. It at-

* Abstracted from "How to Destroy English Sparrows," by N. Dearborn. U. S. Department of Agriculture Farmers' Bulletin 383.

Photo from U. S. Department of Agriculture

ENGLISH SPARROW, MALE AND FEMALE, SHOWING THE MANNER IN WHICH THEY TAKE POSSESSION OF NESTING BOXES PROVIDED FOR NATIVE BIRDS

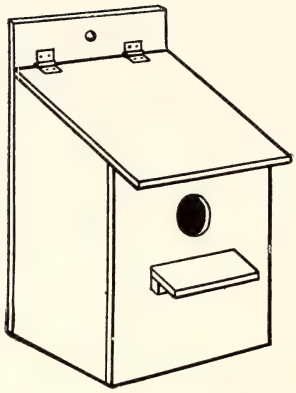
tacks other familiar native birds, as the robin, wren, red-eyed vireo, catbird, and mocking bird, causing them to desert parks and shady streets of towns. Unlike our native birds whose places it usurps, it has no song, but is noisy and vituperative. It defiles buildings and ornamental trees, shrubs, and vines with its excrement and with its bulky nests.

The evidence against the English sparrow is overwhelming, and the present unfriendly attitude of the public toward it is reflected in our State laws. Nowhere is it included among the birds that are protected. In response to frequent inquiries for means of abating the sparrow nuisance received by the United States Biological Survey, a few approved methods applicable to different conditions are here described.

Sparrows frequently give annoyance by roosting in ornamental vines and in crevices about buildings. If driven out late at night, several nights in succession, they will usually desert the roost. A jet of water from a garden hose is a potent disturber, particularly on frosty nights. Where water is not available, small Roman candles may be employed.

Though sparrows may be driven from a given neighborhood, the relief thus obtained is only temporary, and has the further objection that the nuisance is simply transferred elsewhere. More drastic action is therefore preferable.

The most effective method of prevent-



AN INEXPENSIVE NEST BOX FOR ENGLISH SPARROWS

ing the increase of sparrows in a locality is to destroy their nests at intervals of ten or twelve days throughout the breeding season. Occasionally they build large covered nests in trees, but as a rule they build open nests in bird-houses, electric-light hoods, cornices, water-spouts, and similar places. While it is often difficult to reach nests with the hand, they can usually be torn down by means of a long pole having an iron hook at the tip. By a concerted and continued movement to destroy every nest after the eggs are laid, English sparrows in any locality may be gradually reduced without resorting to shot or poison.

The sparrow's habit of nesting in cavities can be turned to account against it. By providing one-room bird-houses, or even packing boxes or tin cans, and putting them in trees or on poles or buildings at a height of about 10 feet, the birds may be captured after dark with the aid of a long-handled net. This net should have a deep bag and a small hoop made to fit the front of the boxes closely. After the net has been quietly placed over the entrance, a few raps on the box will send the tenant into it. Dilapidated buildings may sometimes be fitted up for catching sparrows in this way, as well as for destroying their nests and eggs. The figure on page 951 shows how this can be done. An ordinary wooden box may be nailed to the inside of the building over a hole made to admit the sparrows. The box should be arranged so that the top or upper part of the back can be lifted to gain access to the inside.

The box, also illustrated on this page, is designed to be hung on a building or a tree. Its floor should be about 6 inches square and its height at the eaves about 8 inches. The roof should be hinged at the top for removing the eggs or young. Such boxes may be built of rough boards at slight cost. By distributing a number of them about orchards, shade trees, and out-buildings, and catching the sparrows that occupy them, or by destroying eggs, the work of extermination may be carried on at a season when other methods are least effective.

Preliminary to the following destructive measures, sparrows should be baited until they are attached to the spot selected for their execution. Seeds, grain, or waste from the table, if supplied regularly, will soon establish a feeding place. If a general campaign is to be undertaken, enough such feeding places should be maintained to attract to them practically all the English sparrows in the neighborhood. This can easily be done in winter when food is scarce. After thus baiting the sparrows they may be trapped, shot, or poisoned.

Traps alone are inadequate to exterminate sparrows, but a reduction of numbers can be effected by using a shallow box not less than 4 feet square, open on one side and covered with woven wire on the other. One side of this trap rests on the ground, while the opposite side is supported by a stick 18 inches long. Near the upper end of this stick is attached a long cord, and between the top of it and the edge of the trap is placed a chip. By setting the trap over bait and pulling the cord from a sheltered point of observation when a flock of sparrows is beneath it, numbers of them may be caught. Instead of the box described above, by which the birds are taken alive, an old door or similar device may be employed as a deadfall. In either case the trap should be kept set and baited until the sparrows are not afraid

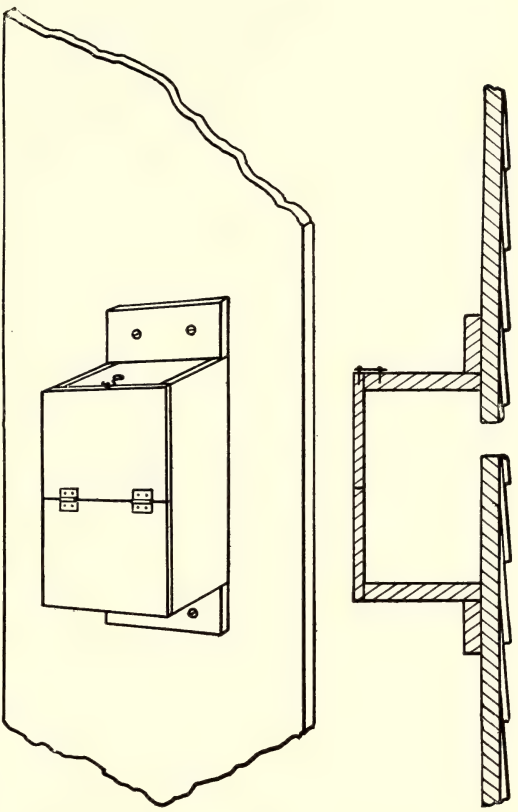
to go under it. The best time for trapping is just after a snowstorm, when the birds have been fasting. Then, if the ground be cleared and chaff and grain be put under the trap, the birds will crowd in and enable the trapper to secure nearly all of the local flock. If any escape they will spread the fear of traps, and before long very few of the birds can be induced to go into one.

Sparrows are accustomed to feed in close flocks, and when thus assembled a large number can be killed by a charge of No. 10 shot. The best way is to scatter grain over long, narrow areas and shoot the sparrows at these baiting places. Where sparrows infest poultry yards, the bait may be placed on a horizontal board, supported at such an elevation that the birds can be shot without danger to the poultry.

Since English sparrows are a pest and a reduction of their numbers is important on economic grounds, there would seem to be no reason why the birds, when trapped or shot, should not be utilized for food in this country, as they have been in the Old World for centuries. Their flesh is palatable and nutritious, and in city restaurants they are often served under the name of reed birds.

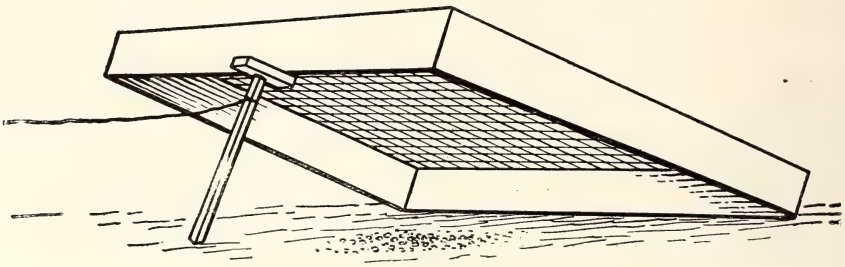
Where the use of poison is not prohibited by law, it may be effectively used to reduce the number of sparrows. Of the different poisons tested, the most satisfactory is strychnia sulphate. It is easily prepared and acts quickly. Wheat has proved to be a good bait, as well as an excellent vehicle for administering the poison. The grain should be regularly supplied at the baiting stations until the birds have become accustomed to resort to the place. A good time to put it out is early morning, as the birds are sure to be hungry for breakfast. The capacity of the sparrow's crop and stomach is about 30 kernels of wheat, varying according to size of the kernels.

In deciding the amount of poisoned wheat to put out at one time, it is well to estimate the number of sparrows frequenting a feeding place and to allow about 20 kernels for each sparrow.



PERSPECTIVE AND SECTIONAL DRAWINGS OF AN IMPROVISED NESTING-BOX FOR THE INTERIOR OF BUILDINGS

Although 2 kernels of wheat coated with the solution described below have been known to kill a sparrow, 6 or 7 kernels are required to insure fatal results. Only as much poison should be put out as is likely to be eaten in one day, as exposure to moisture reduces its virulence. Furthermore, sparrows that take less than a fatal quantity, or that become frightened by the death of comrades, will forsake a feeding place if poison is kept there constantly. It is better, therefore, to supply unpoisoned wheat after each poisoning until the birds have recovered confidence. An important advantage in having several feeding grounds is that they may be used in rotation, the sparrows forgetting their fear of one while the others in turn are receiving poison.



A SPARROW TRAP

A poison mixture that has proved very effective is prepared as follows: Put one-eighth ounce of strychnia sulphate into three-fourths of a gill of hot water and boil until dissolved. Moisten 1½ teaspoonfuls of starch with a few drops of cold water, add it to the poison solution, and heat till the starch thickens. Pour the hot poisoned starch solution over 1 quart of wheat and stir until every kernel is coated. Small-kerneled wheat sold as poultry food, if reasonably clean, is preferable to first-quality grain, being cheaper and more easily eaten by the sparrows. A 2-quart glass fruit jar is a good vessel to mix in, as it is easily shaken and allows the condition of the contents to be seen. If the coated wheat be spread thinly on a hard, flat surface, it will dry enough for use in a short time. It should be dried thoroughly if it is to be put into jars and kept for future use. Dishes employed in preparing poison may be safely cleansed by washing.

The poison should be well scattered, so that many birds may be able to partake at the same time, since after a few are affected their actions excite the suspicion of their comrades. Usually a few sparrows get only enough strychnine to paralyze them for a few hours, after which they recover. It is important, therefore, to visit the feeding places two or three hours after distributing poison to prevent such birds from escaping. It is well also to remove dead birds promptly to avoid exciting the suspicions of those that are unaffected. In northern latitudes the best time to put out poison is just after a snowstorm, when other food is covered. The feeding place should be cleared of snow and the poison laid early in the morning.

Sparrows should be baited in secluded places, safe from interruptions and where doves and poultry are not endangered. Roofs, back yards, and unused poultry runs are favorable situations. Proximity to low trees, grape arbors, and similar retreats has the advantage that sparrows go to such places between meals, and many dead birds will be found there well away from the bait. If undisturbed, poisoned birds will usually be found within a few feet of where the bait was spread, death occurring in from three to twenty minutes. Where doves or poultry are likely to be poisoned, the sparrows, after being baited, may be induced to feed in small covered pens made of coarsely meshed wire netting and having the sides raised about an inch and a half above the ground. There is practically no danger that cats or other animals will die from eating sparrows that have been poisoned. Any wheat coated by the above process, which is overlooked by the birds, will become harmless after a few rains.

Sparrows can be reduced locally to almost any desired extent by the methods outlined above, but it should not be forgotten that such reduction can be made permanent only by systematic and continued efforts.

MR ROOSEVELT'S "AFRICAN GAME TRAILS"*

IN these greatest of the world's great hunting grounds there are mountain peaks whose snows are dazzling under the equatorial sun; swamps where the slime oozes and bubbles and festers in the steaming heat; lakes like seas; skies that burn above deserts where the iron desolation is shrouded from view by the wavering mockery of the mirage; vast grassy plains where palms and thorn trees fringe the dwindling streams; mighty rivers rushing out of the heart of the continent through the sadness of endless marshes; forests of gorgeous beauty, where death broods in the dark and silent depths.

"There are regions as healthy as the northland, and other regions, radiant with bright-hued flowers, birds, and butterflies, odorous with sweet and heavy scents, but treacherous in their beauty and sinister to human life. On the land and in the water there are dread brutes that feed on the flesh of man, and among the lower things that crawl, and fly, and sting, and bite, he finds swarming foes far more evil and deadly than any beast or reptile—foes that kill his crops and his cattle; foes before which he himself perishes in his hundreds of thousands. . . .

"The land teems with beasts of the chase, infinite in number and incredible in variety. It holds the fiercest beasts of ravin, and the fleetest and most timid of those beings that live in undying fear of talon and fang. It holds the largest and the smallest of hoofed animals. It holds the mightiest creatures that tread the earth or swim in its rivers; it also holds distant kinfolk of these same creatures, no bigger than woodchucks, which dwell in crannies of the rocks and in the treetops. There are antelope smaller than hares, and antelope larger than oxen. There are creatures which are the

From "African Game Trails," by Theodore Roosevelt. Copyright by Charles Scribner's Sons

THE MONITOR LIZARD ROBBING A CROCODILE'S NEST

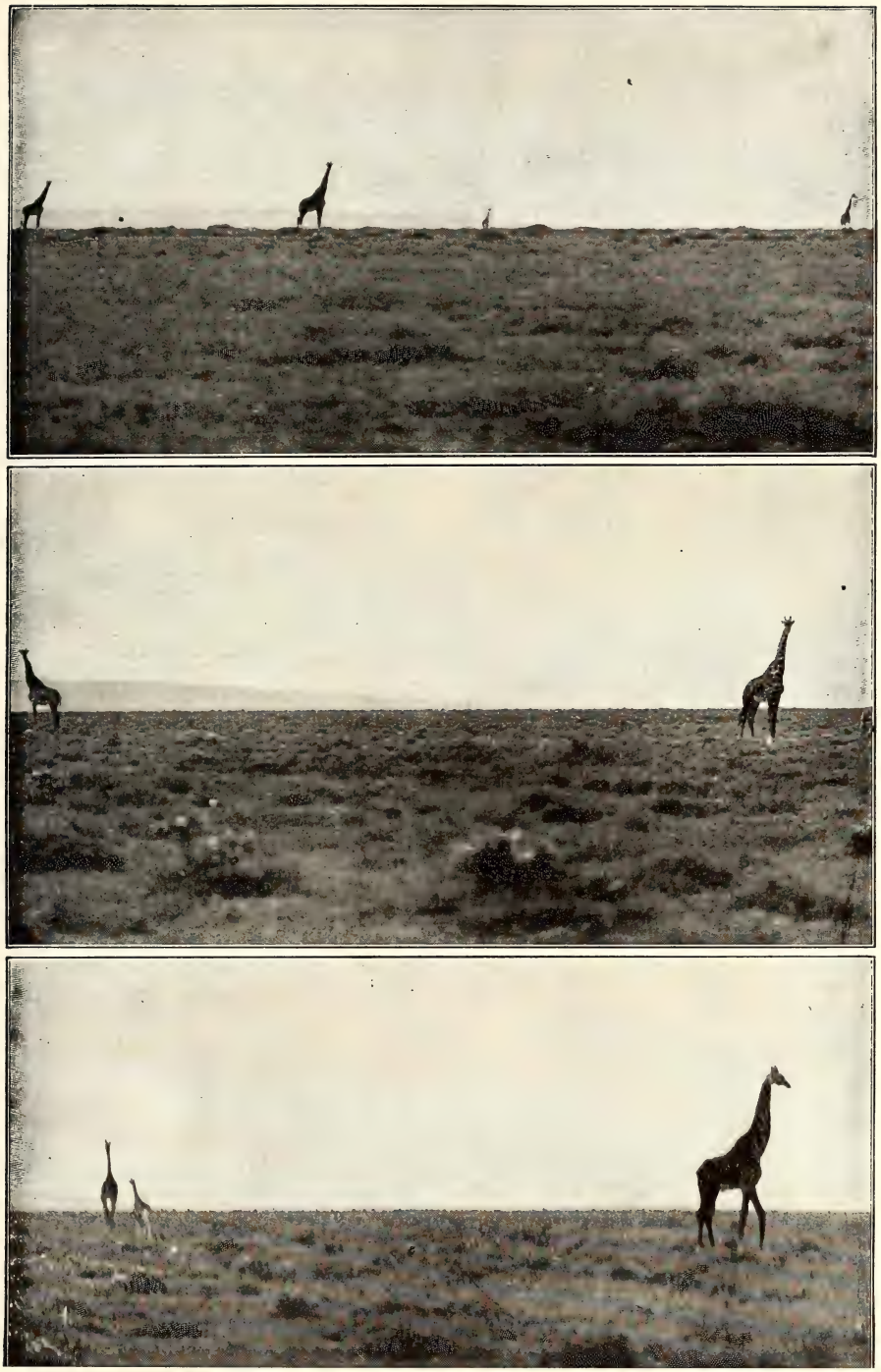
From a photograph by J. Alden Loring

*African Game Trails. An account of the African wanderings of an American Hunter-Naturalist. By Theodore Roosevelt. With illustrations from photographs by Kermit Roosevelt and other members of the Expedition, and from drawings by Philip R. Goodwin. New York: Charles Scribner's Sons. 1910. $4.00 *net*.

From "African Game Trails," by Theodore Roosevelt. Copyright by Charles Scribner's Sons

AN IMPALLA BUCK KILLED BY KERMIT ROOSEVELT AT LAKE HANNINGTON, SHOWING THE BROKEN HORN OF ANOTHER RAM IMBEDDED IN ITS NECK

From a photograph by Kermit Roosevelt



From "African Game Trails," by Theodore Roosevelt. Copyright by Charles Scribner's Sons

GIRAFFE AT HOME

From photographs by Kermit Roosevelt

From "African Game Trails," by Theodore Roosevelt. Copyright by Charles Scribner's Sons

ONE OF THE MOST REMARKABLE PHOTOS OF WILD GAME EVER MADE: A HERD OF ELEPHANT IN AN OPEN FOREST OF HIGH TIMBER

From a photograph by Kermit Roosevelt, taken from a distance of about twenty-five yards; he was on the dead limb of a tree five or six feet from the ground

From "African Game Trails," by Theodore Roosevelt. Copyright by Charles Scribner's Sons

AS THE LION FELL HE GRIPPED A SPEAR-HEAD IN HIS JAWS WITH SUCH TREMENDOUS FORCE THAT HE BENT IT DOUBLE (SEE PAGE 960)

From a photograph by Kermit Roosevelt

embodiments of grace, and others whose huge ungainliness is like that of a shape in a nightmare."

The preceding paragraphs, quoted from Mr Roosevelt's foreword to the narrative of his African expedition, introduce the reader to the wonder world where he collected specimens for the National Museum for nearly one year. The sights which he saw are described so vividly and accurately that even the most quiet and unimaginative citizen thousands of miles from the scene of Africa's grandeur can easily picture the extraordinary contrasts which remain so fixed in Mr Roosevelt's mind, and is also stirred by the wondrous beauty and weird surroundings which Mr Roosevelt so keenly enjoyed.

The book is an unusual contribution to science, geography, literature, and adventure. Naturalists will prize the accurate descriptions of the huge beasts by a hunter-naturalist who for 30 years had been studying the big game of America in their native haunts, and who has contributed much to a better appreciation of the large animals of our continent. Mr Roosevelt's acquaintance with big game in America prepared him to observe the great bulky creatures of Africa with eyes quick to note and understand. He is the first naturalist of much experience with American big game to study all the large species of Africa, so that his comparisons and observations form a particularly valuable contribution to knowledge.

The geographer will perhaps be even more interested in the accounts of the people and of the country. In the first chapter, "Through the Pleistocene," he reads of a land where wild man and wild beast do not differ materially from what they were in Europe many thousands of

From "African Game Trails," by Theodore Roosevelt. Copyright by Charles Scribner's Sons

THE COW AND CALF SQUARE-NOSED RHINO UNDER THE TREE AFTER BEING DISTURBED BY THE CLICK OF THE CAMERA

From a photograph by Kermit Roosevelt, whose pictures of white rhino are the first photographs ever made of this rare animal alive

From "African Game Trails," by Theodore Roosevelt. Copyright by Charles Scribner's Sons

A WHITE RHINO AND CALF

The calf, which was old enough to shift for itself, refused to leave the body. From a photograph by Kermit Roosevelt

years ago, in the age when our ancestors in Europe went absolutely naked and lived in constant dread of furious beasts. Into this land European civilization is rushing with tremendous sweep and reaping big commercial profits. It is a strange sight as the train, drawn by an American Baldwin locomotive, rolls into the towns to see groups of naked savages with oddly shaved heads and filed teeth, armed with primitive bows and arrows, and women whose ideas of the requirements of dress are fully satisfied by masses of bronze or copper wire wound tightly around the arms and legs.

"One group of women, nearly nude, had their upper arms so tightly bound with masses of bronze and copper wire that their muscles were completely malformed. So tightly was the wire wrapped round the upper third of the upper arm that it was reduced to about one-half of its normal size, and the muscles could only play, and that in deformed fashion, below this unyielding metal bandage. Why the arms did not mortify it was hard to say, and their freedom of use was so hampered as to make it difficult to understand how men or women whose whole lives are passed in one or another form of manual labor could inflict upon themselves such crippling and pointless punishment."

Kermit Roosevelt's photographs of the big game are unusually fine. Those of the elephant herd, of which one is printed on page 956 of this Magazine, are better than any of wild elephants that have ever been taken, while those of the white, or square-nosed, rhino (see pages 958, 959) are, so far as we know, the first live pictures of this rare animal that have ever been made. To photograph the elephant requires especial courage and ability. The huge beast is exceedingly wary and suspicious and easily

aroused to anger. Their strength is prodigious. "They work vast havoc among the young or small growth of a forest, and the readiness with which they uproot, overturn, or break off medium-sized trees conveys a striking impression of their enormous strength. I have seen a tree a foot in diameter thus uprooted and overturned."

The elephant formerly wandered freely over the plains, but, learning some years ago that the open country was becoming dangerous, owing to the advent of the white man and his rifle, he took to the forests and can now be found only after days of fatiguing pursuit in the thickest woods. There is no danger, says Mr Roosevelt, that this magnificent animal will become extinct, because large elephant reserves have been established; and, furthermore, wise regulations have been adopted and are being enforced, such as prohibiting the sale of tusks below a certain size, the shooting of females except for museums, etc.

Not the least interesting portions of Mr Roosevelt's narrative are his descriptions of the small mammals, birds, and the ants, bees, and deadly flies and ticks.

The dreaded driver ants "are carnivorous; I have seen both red and black species. They kill every living thing in their path, and I have known them at night drive all the men in a camp out into the jungle to fight the mosquitoes unprotected until daylight. On another occasion, where a steamboat was moored close to a bank, an ant column entered the boat after nightfall and kept complete possession of it for 48 hours. Fires and boiling water offer the only effectual means of resistance. The bees are at times as formidable; when their nests are disturbed they will attack every one in sight, driving all the crew of a boat overboard or scattering a safari, and not infrequently killing men and beasts of burden that are unable to reach some place of safety."

Among the first specimens obtained were a cow and bull of the ugly wildebeest. "They were covered with ticks, especially wherever the skin was bare. Around the eyes the loathsome creatures swarmed so as to make complete rims like spectacles, and in the armpits and the groin they were massed so that they looked like barnacles on an old boat. It is astonishing that the game should mind them so little. The wildebeest evidently dreaded far more the biting flies which hung around them, and the maggots of the bot-flies in their nostrils must have been a sore torment. Nature is merciless, indeed."

Few of the many millions of Americans who in coming years will admire and profit from the splendid series of specimens of African big game obtained by Mr Roosevelt for our National Museum have any conception of the immense physical labor, the careful planning, and extensive preparations required to secure this complete collection. As an instance of the labor involved, we mention the hunt for the giant eland, the largest and handsomest and one of the least known of African antelopes, described in the last chapter of the book "Down the Nile." This giant antelope with its powerful horns easily breaks off branches two or three inches in diameter and seven or eight feet from the ground to get at the leaves and bean-pods of the tree which forms its favorite food.

This task involved an 8-days' trip from Gondokoro through a hard, dry, barren country and in temperatures of 112 degrees in the shade at noon. Kermit was the only white man to accompany Mr Roosevelt, as all the other white men of the party were down with dysentery or fever.

"It took me three days' work before I got my eland. Each day I left camp before sunrise, and on the first two I came back after dark, while it always happened that at noon we were on a trail and could not stop. . . . On the third day we found the spoor of a single bull by 8 o'clock. Hour after hour went by while the gun-bearers, even more eager than weary, puzzled out the trail. At half past 12 we knew we were close on the beast, and immediately afterward caught a glimpse of it. Taking advan-

tage of every patch of cover, I crawled toward it on all-fours, my rifle too hot for me to touch the barrel, while the blistering heat of the baked ground hurt my hands. At a little over a hundred yards I knelt and aimed at the noble beast. I could now plainly see his huge bulk and great, massive horns, as he stood under a tree." The first shot brought him down. "Meanwhile Kermit had killed two eland—a cow on the first day, and on the second a bull even better than, although not quite so old as, mine. Kermit could see game and follow tracks almost as well as his gun-bearers, and in a long chase could outrun them."

But to save the three big skins in that climate was even harder work than the many hours of hunting had been, but they did it, though it took till midnight to get the skins in proper condition for transportation.

The buffaloes, and particularly the very rare square-nosed or "white" rhino, demanded even greater exertions of the party. Of the square-nosed rhino (see pages 958, 959) only two specimens, and both very poor ones, had been previously secured for any museum, one being at Berlin and the other at London. Mr Roosevelt shot five splendid specimens in the Lado and Kermit four, and all nine animals were saved for the U. S. National Museum.

No one can read the volume without being impressed by the serious purpose of the leader and of every member of his staff. This was in no sense a hunting party for the collection of record heads and horns, but an expedition organized, equipped, and directed by some of the ablest naturalists in the world, all of whom were animated with the sole ambition to bring back some contribution to science.

While the leader and his son were toiling strenuously for the big-game specimens, Major Mearns, Dr Loring, and Mr Heller were collecting and trapping (they took hundreds of traps with them) long series of rats, mice, squirrels, monkeys, shrews, bats, lizards, reptiles, birds, fishes, and plants. Every man had his particular field of work and did it well, with the result that our National Museum will possess the finest and most valuable collection of African fauna in any museum.

Mr Roosevelt during the trip shot with the rifle 296 big game and Kermit 216—a grand total of 512. "Kermit and I kept about a dozen trophies for ourselves; otherwise we shot nothing that was not used either as a museum specimen or for meat—usually for both purposes. We were in hunting grounds practically as good as any that have ever existed; but we did not kill a tenth nor a hundredth part of what we might have killed had we been willing. The mere size of the bag indicates little as to a man's prowess as a hunter, and almost nothing as to the interest or value of his achievement."

To the writer of this review, "African Game Trails" appeals as the strongest and best work of literature Mr Roosevelt has yet written. The word pictures are extraordinarily vivid and realistic. He who seeks stories of adventure will be entranced by the many strange situations, and will rejoice in such descriptions as that of the hunt of a lion by the naked Nandi warriors armed only with shields and spears.

"One by one the spearmen came up, at a run, and gradually began to form a ring round him. Each, when he came near enough, crouched behind his shield, his spear in his right hand, his fierce, eager face peering over the shield rim. As man followed man, the lion rose to his feet. His mane bristled, his tail lashed, he held his head low, the upper lip now drooping over the jaws, now drawn up so as to show the gleam of the long fangs. He faced first one way and then another, and never ceased to utter his murderous grunting roars. It was a wild sight—the ring of spearmen, intent, silent, bent on blood, and in the center the great man-killing beast, his thunderous wrath growing ever more dangerous.

"At last the tense ring was complete, and the spearmen rose and closed in. The lion looked quickly from side to

side, saw where the line was thinnest, and charged at his topmost speed. The crowded moment began. With shields held steady and quivering spears poised, the men in front braced themselves for the rush and the shock, and from either hand the warriors sprang forward to take their foe in flank. Bounding ahead of his fellows, the leader reached throwing distance; the long spear flickered and plunged; as the lion felt the wound he half turned, and then flung himself on the man in front. The warrior threw his spear; it drove deep into the life, for entering at one shoulder it came out of the opposite flank, near the thigh—a yard of steel through the great body. Rearing, the lion struck the man, bearing down the shield, his back arched, and for a moment he slaked his fury with fang and talon. But on the instant I saw another spear driven clear through his body from side to side; and, as the lion turned again, the bright spear blades darting toward him were flashes of white flame. The end had come. He seized another man, who stabbed him and wrenched loose. As he fell he gripped a spear-head in his jaws with such tremendous force that he bent it double. Then the warriors were round and over him, stabbing and shouting, wild with furious exultation.

"From the moment when he charged until his death I doubt whether ten seconds had elapsed, perhaps less; but what a ten seconds! The first half dozen spears had done the work. Three of the spear-blades had gone clear through the body, the points projecting several inches, and these and one or two others, including the one he had seized in his jaws, had been twisted out of shape in the terrible death struggle."*

*All the quotations from "African Game Trails" are copyrighted by Charles Scribner's Sons.

A DEFORMED BRANCH OF A HACKBERRY TREE WHICH HAS BEEN INFECTED BY MISTLETOE FOR TEN TO TWELVE YEARS, NEAR BELTON, TEXAS

The dwarfing of the branch beyond the place of infection is shown. The original mistletoe plant has been destroyed, leaving a decayed spot. The young shoots of mistletoe seen are from adventitious buds.

Photos from William L. Bray, U. S. Department of Agriculture.

A CEDAR ELM TREE ON A VACANT LOT IN AUSTIN, TEX., SHOWING ITS WINTER CONDITION

All the foliage is mistletoe (see page 965)

AN ISOLATED HACKBERRY TREE NEAR BELTON, TEX., WITH INNUMERABLE BUNCHES OF MISTLETOE

This tree is in its winter condition, being absolutely without leaves of its own

MUD-CRACKS IN THE VALLEY OF THE LOWER COLORADO (SEE PAGE 967)

The revolver on one of the central blocks is a .38 Smith & Wesson Military, just 12 inches in total length. This gives an idea of the width of the cracks. Photo by J. Griffin

THE MUD-CRACKS UTILIZED: BEETS IN THE FOREGROUND, PEAS AT LEFT, WHEAT AT RIGHT, THE LATTER BEING THE CORNER OF A 10-ACRE TRACT (SEE PAGE 967)

At flood-time the previous June water covered this area to a depth of 8 feet, as shown by the mud-stain on willow trunks in the vicinity. Photo taken April 17, 1910, by J. Griffin.

THE MISTLETOE

PEOPLE living in northern cities who purchase small strings or bunches of mistletoe at a good price for Christmas decoration rarely are aware that it is one of the most destructive tree parasites known. There are localities in the South, particularly in Texas, where mistletoe is so abundant upon trees and so harmful as to make the control of the plant and its extermination a serious practical question. It is spread principally by birds—mocking-birds, robins, wax-wings, and cedar-birds—who carry the mistletoe berry from tree to tree. The sinker of the seedling pierces the tenderest portions of the tree, young branches or buds, and sucks away the tree's vitality by draining the water and nourishment of the tree (see pages 962, 963).

OUR COLORED PICTURES

IN this number of the Magazine, for the first time, the National Geographic Society publishes a large series of illustrations in color. These pictures are all from photographs taken by Mr William W. Chapin, a well-known citizen of Rochester, New York, and an amateur photographer of much skill. The photographs were colored by hand, under Mr Chapin's direction, by a Japanese artist. By the use of colors, the atmosphere and reality of foreign scenes in many instances can be more accurately and graphically portrayed than in the usual black-and-white illustration. This is particularly true of the Orient, where the use of bright, striking pigments—golden yellows, rich reds and blues and greens—are so prevalent in dress and street deco-

From "Hunting with the Eskimos," by Harry Whitney. Copyright by Century Company

STRIPPING BLUBBER FROM A WHALE

"In these modern factories every part of the whale is utilized. The oil and whalebone of commerce are very valuable, and the manufacture of the carcass into guano after the oil has been extracted is an industry in itself. Until recently the oil-freed carcass was considered useless refuse. It was towed 50 miles out to sea and abandoned. The law required this, that the fishing grounds might not be polluted. But a voyage of 50 miles to sea and back again is costly, and through experiment it was learned, not only that this expense might be saved, but that it was possible to manufacture the refuse into a valuable commodity. So every part of the whale is turned to account except the smell. Human ingenuity cannot control that."—HARRY WHITNEY.

From "Hunting with the Eskimos," by Harry Whitney. Copyright by Century Company

MR HARRY WHITNEY IN A WHALE'S MOUTH

ration and in the architecture of the buildings.

The process by which the 39 pictures were engraved and reproduced for this Magazine cost the Society more than several ordinary issues of the publication, but it is believed that the beauty of the illustrations and the vivid manner in which the striking contrasts of eastern life are actually represented will more than compensate for the expense. The expenditure was made possible by the increasing revenue of the Society from the general sale of the Magazine and from advertising receipts. The Society will be glad to hear from the members what they think of the series, which incidentally is the largest collection of photographs in color ever published in a single issue of any magazine.

THE MAN WITHOUT THE HOE

PROBABLY nowhere in the United States is a more unique method of farming practiced than the one carried on by the few dwellers along the banks of the lower Colorado River, on the Cali-

A BATETELA DRUMMER OF THE BELGIAN CONGO SENDING A MESSAGE BY A WOODEN GONG

The natives of this part of Africa are celebrated for their proficiency in transmitting elaborate messages long distances by means of these resonant instruments. The women of these people wear enormous neck-rings of brass which frequently exceed 30 pounds in weight. Photo from E. Torday, in the Geographical Journal of London.

A BEAK-FACED WOMAN IN THE MUSGUN COUNTRY OF FRENCH NIGERIA, NEAR LAKE TCHAD

These people are magnificent specimens of humanity, but their women are exceedingly ugly. The upper and lower lips of their wives are pierced and have large discs of tin looking-glass and Maria Theresa dollars inserted in them. Photo from Dr Karl Kumm, in the Geographical Journal of London.

fornia side, some 45 miles above Yuma. The narrow flood-plain on either side of the Colorado at this point is lower than the banks immediately paralleling the river itself. Ordinarily the river runs between its self-made dikes of silt; but in June, when the melting snows of the mountains at its source enormously swell its volume, it overflows its banks and inundates the low ground on either side. These lateral bottom lands are covered with a dense growth of willow, arrow-weed, etc., and it is in the original clearing of them that the farmer meets with his hardest task. For, once cleared and fenced against the cattle that range the river bottom, his procedure is simple in the extreme.

In the arable valleys the flood-waters cover the land little more than a month, being drained by natural systems of sloughs soon after the high water recedes. There is thus yearly left after the subsidence of the waters a new deposit of rich alluvial mud. In the fierce heat of the desert sun and with a relative atmospheric humidity of as low as five per cent, the rate of evaporation is extraordinary and the surface of the mud dries quickly. As it dries it cracks, marking the whole surface into large blocks of fairly rectangular form, the cracks between them being from one to five inches in width and about twice as deep (see pages 964, 965).

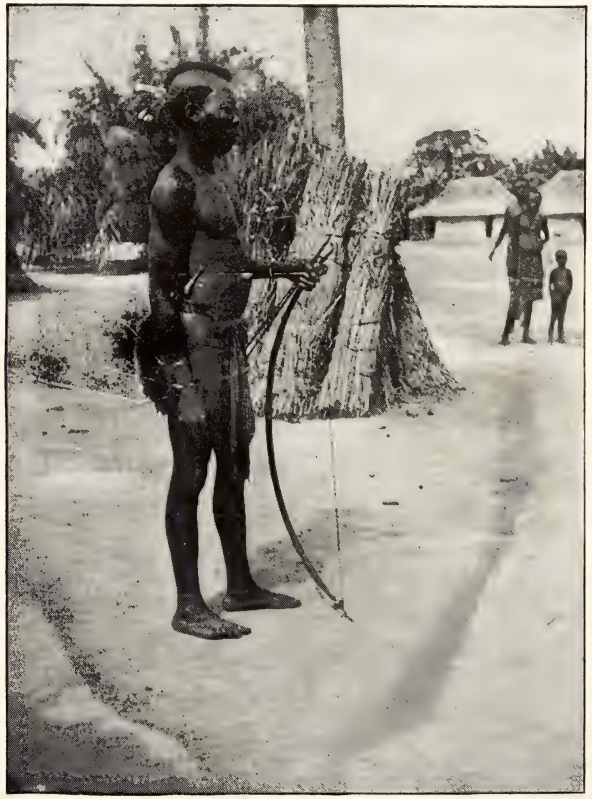
The ground thus prepares itself for the seeding, which takes place in late autumn. The farmer merely sows his seed broadcast over this surface, then brushes over it with rude brooms made of arrow-weed, so that all the seed finds lodgment in the open cracks. Abundant moisture remains beneath the sheltering cakes of dried mud, and grain and all sorts of vegetables thrive splendidly. No cultivation of any sort is given, and all that remains for the farmer to do is to harvest his crop, in April or May, before the next season's flood. Surely Nature is nowhere kinder to the farmer than here, where his fields are yearly irrigated, fertilized, and plowed for him by her forces.

AMONG THE CANNIBALS OF BELGIAN KONGO

A RECENT number of the Geographical Journal of London contains an account by E. Torday of two years passed in the Kasai country of the Belgian Kongo. While the region explored is no larger than New York and Pennsylvania combined, it is so cut up by rivers and impenetrable forests that the tribes inhabiting the country vary greatly in their customs and language. Mr Torday found cannibals living undisturbed, and only a few miles distant geographically from these barbarous savages were endless plantations of millet and grain, tended by the most progressive negroes of Africa. The following notes are from his paper:

Each chief in the Bushongo country has a small group of pygmies under his suzerainty. These people hunt for him, and he provides them with vegetable food in exchange for their game. Now one group, abandoning the nomadic life, has established itself in a small village and has taken to agriculture. Only two generations have passed since they left the forest, and they have already lost their pygmy appearance. Though not as big as the Bushongo, they have attained a stature far superior to that of the average pygmy. As intermarriage between Bushongo and these "half ghosts" (which they are considered to be) is out of the question, it must be admitted that sunshine, air, and regular life have been the main factors in this change. The Bushongo, who believe that pygmies are semi-ghosts born from crevices of old trees, told us that these Batwa, since the time they adopted the normal life of human creatures, even reproduce like ordinary men, and showed us, as a great curiosity, some normally born young babies.

I cannot even make an attempt to give a description of the art of this people. Those who take interest in it will find in the British Museum many hundreds of objects collected by me, and will be obliged to admit that a really pure African art has been evolved by them—an art which must be ranked high, even



A BATETELA OF THE BELGIAN KONGO

Note the peculiar method of shaving the head. The members of this tribe were formerly cannibals, but have now become splendid agriculturalists and stock-breeders. They are very industrious and progressive. See page 971.

A BANKUTU CANNIBAL OF THE BELGIAN KONGO

The scars on the man's body show the tribe to which he belongs. These savages use poisoned arrows and spring guns. See page 971.

when judged by the standard of civilized peoples.

Cicatrization is practiced by all the tribes; in some by the men only, in others by the women only. The tribal mark of one tribe consists in a series of concentric circles on each temple. The incisor teeth are all filed to a point, and from this circumstance the Basongo Meno have received the tribal name which they now bear, meaning "People with filed teeth."

The cannibal Bankutus remove the upper incisors. Their dress consists of a pleated skirt, which does not quite meet on the right thigh; but the women in the south wear a hide girdle with a deep fringe of palm-fiber string. Among this tribe the slaves are compelled to wear a special dress, which is, in fact, the ordinary costume of the Akela, to which tribe most of them belong.

The Bankutu are great cannibals, as far as the male members of the tribe are concerned, and the victims are always slaves. In fact, all slaves are ultimately eaten, since it is believed that if a slave were buried his ghost would kill his master.

Their chief weapon is the bow, and poison is used on the arrows; shields are now obsolete. Property descends in the male line, but there are indications that at one time relationship was considered stronger on the female side. One of the most interesting points among this tribe is their use of a conventional throwing-knife as currency. The Basongo Meno also use this form of currency, obtaining it from the Bankutu, who are the manufacturers. The Bankutu are almost the only tribe of this region who have been successful up to the present in resisting the advance of the white man. This fact is due to their skill in forest warfare.

It is difficult to give a description of Bankutu warfare without falling into the style of the literature which so successfully educates the future Bill Sykes. It will suffice to say that the way leading to their village is defended by poisoned spikes hidden by leaves; that they use bows and arrows set like traps in the form of primitive spring guns, and are quite ready, if a white man is expected, to bait such traps with a live baby, being sure that the European will be unable to resist the temptation to pick up an apparently abandoned child. The poison they use is absolutely deadly. We were most inhospitably received by them, but no violence was attempted toward us, although we had no escort. When we reached Kole we were criticised for crossing such a country without an armed force. Our reason for taking this risk was that, had we had troops with us, we should have never seen the natives at all, and most likely should have been ambushed.

Only a few score miles from the cannibal country we found peace and security reigning everywhere. The endless plantations, clean villages, and well-kept houses made an impression of general prosperity. Of course, equal credit for this must be given to the character of the population; the Batetela is an excellent agriculturist and stock-breeder and very industrious. He is the least conservative of all negroes I know; any innovation will tempt him. Rice, Madagascar potatoes, and fruit trees imported by the white man are found in every village. We were received in all of these with the greatest hospitality, and in one village the chief presented us with 500 huge rations for our 50 carriers.

The people are scantily clothed, but this is, of course, of great advantage in their hunting expeditions. The havoc of sleeping sickness is greatly limited by the native custom of isolating cases of this disease in the forest. Several of the villages are assuming the proportions of towns. The native pattern of hut is discarded, and plaster-thatched houses, laid out in neat and regular streets, have taken their place. The neatness and cleanliness of these villages are most remarkable.

An interesting feature of Batetela psychology lies in the fact that suicide appears not to be uncommon and is regarded as an act of courage. Descent is reckoned in the male line, and children are considered as more closely akin to the father's family.

NATIONAL GEOGRAPHIC SOCIETY

THE program of addresses before the National Geographic Society for 1910-1911 is as follows:

November 18.—"Wild Man and Wild Beast in Africa." By Colonel Theodore Roosevelt.

November 25.—"A Glimpse of Portugal." By Miss Laura Bell. Miss Bell was in Portugal for several months during the past summer, and has had an exceptional opportunity to understand the people and conditions of this picturesque country. Illustrated.

December 2.—"Four Journeys of a Naturalist in the Islands of the South Pacific." By Henry E. Crampton, Ph. D., of the American Museum of Natural History. Dr Crampton will tell of his travels in the Society, Cook, Tonga, Samoan and Hawaiian Islands, and in New Zealand. The natives, their every-day lives and ceremonies, the active volcanoes of Samoa and Hawaii, and the free life of the Pacific will be described. Illustrated.

December 9.—"My Friends, the Indians." By Mr Frederic Monsen. Illustrated with colorgraphs and motion pictures. Mr Monsen for years has been studying the Indians of Arizona and New Mexico, and his series of pictures of Indian life and manners are as beautiful as they are instructive.

December 16.—"The Glories, Sorrows, and Hopes of Ireland." By Mr Seumas MacManus, author of "A Lad of the O'Friel's," "Through the Turf Smoke," "Donegal Fairy Stories," "Ballads of a Country Boy," etc. Illustrated.

December 23.—Christmas recess.

December 30.—"From Babel to Esperanto—the Complication of Mother Tongues and the Simplicity of Esperanto." By Prof. A. Christen. Professor Christen is the leading authority on Esperanto. The growth of internationalism and the need of a world tongue lend interest to this topic. "Esperanto is spreading in almost every European nation, and is more easily learned and pronounced than any other foreign language. It is taught in all the higher military and naval schools of France, and at Lille has been taught in the public schools for the past three years."

January 6.—"Arab Life in Tunisia." By Frank Edward Johnson. Mr Johnson has probably seen more of the Barbary States than any other American. His lecture includes Tunis ("the White City"), the remains of Carthage and other buried Roman cities, Kairowan with its 85 mosques and 90 praying places, and descriptions of the Arabs in the oases and in the desert. Illustrated

January 13.—"The Methods, the Achievements, and the Character of the Japanese." By Mr George Kennan. Illustrated.

January 20.—"Making Pictures. The Wonderful Development of the Art of Photography and Its Value to Education and Commerce." By Hon. O. P. Austin, Chief of the United States Bureau of Statistics and Secretary of the National Geographic Society. Illustrated with motion pictures.

January 27.—"The Panama Canal." By Col. George W. Goethals, Chief Engineer Panama Canal. Illustrated.

February 3.—"Our Plant Immigrants." By Mr David Fairchild, in charge of Agricultural Explorations of the Department of Agriculture. The hunt for valuable new plants and fruits takes the agricultural explorers to many unknown corners of the world, and is a fascinating story of achievement. Illustrated.

February 10.—"The Balkan States." By Mr E. M. Newman. With motion pictures.

February 17.—"The Heart of Turkestan." By Mr William E. Curtis. Illustrated.

February 24.—"The Italy of Today." By Maj. Gen. A. W. Greely, U. S. Army. General Greely has just returned to the United States after spending a year in Italy, where he obtained much information as to the remarkable progress of modern Italy. Illustrated.

March 3.—"The Birds of Mexico." By Mr Frank M. Chapman, of the American Museum of Natural History. With motion pictures of roseate spoon-bills, man-o'-war birds, and white ibises.

March 10.—"From the Amazon to the Orinoco. The Five Guianas." By Mrs Harriet Chalmers Adams. With motion pictures.

March 17.—"Travels and Experiences in Mexico." By Mr John Birkinbine, President of the American Institute of Mining Engineers. Illustrated.

March 24.—"The Shrines of Greece: Olympia, Delphi, Eleusis, Athens, Mycenæ, Tiryns, Epidauros, and the Island of Crete." By Miss Marion Cock. Illustrated.

March 31.—"The Romance and Grandeur of Spain." By Dr Charles Upson Clark, of Yale University. Illustrated.

April 7.—It is hoped that former Vice-President Charles W. Fairbanks will be able to address the Society on this date on some subject connected with his recent journey around the world.

April 14.—"The Fiords and Fisheries of Norway." By Dr Hugh M. Smith, Deputy Commissioner of the Bureau of Fisheries. With motion pictures.

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THE NATIONAL GEOGRAPHIC MAGAZINE

RACE PREJUDICE IN THE FAR EAST

BY MELVILLE E. STONE

GENERAL MANAGER OF THE ASSOCIATED PRESS

ALTHOUGH whole libraries have been written concerning Asia and the Asians, there is a widespread belief that, because of the differences in our mentalities, it is not possible for us ever to understand them, or they us. Kipling says that "East is East, and West is West, and never the twain shall meet." The "oldest inhabitant" in India or China or Japan is sure to tell you that the Oriental mind is unfathomable. I have not the temerity to challenge these opinions. And yet I venture to suggest that there is an older authority holding a different view, and that I still have some respect for Cicero's idea that there is a "common bond" uniting all of the children of men.

And whatever our ignorance of, or indifference for, the Orientals in the past, it is well to note that conditions, both for us and for them, have entirely changed within the last decade. There is a new United States and a new Asia. The Spanish War created the one; the Russo-Japanese War the other. When we acquired the Philippine Islands we assumed the government of eight millions of Orientals and touched elbow with all Asia. When Japan defeated Russia, the Oriental learned his power. For untold centuries he had respected power. His native sovereign was an autocrat, who enslaved him, beat him, killed him, if need be. Then came the European, with powder and guns and warships; and thereafter the white man behind the gun represented power. A handful of British with cannon could enforce obedience from hundreds of millions of people. Suddenly the little Empire of Japan, one of the least among the Asiatic powers, challenged, fought, and defeated the great European Colossus, Russia.

The Asian discovered then that it was not the white man, but the gun that did the business; he learned that a yellow man behind the gun was quite as effective as a white man, and he found that the Christian soldier alone was afraid of death. Then followed in travail the birth of the new Asia. There were actual revolutions in Turkey and Persia, a startling recrudescence of unrest in India and Ceylon, and, at this moment, China is in a state of revolutionary ferment.

What is to be the outcome? What does all this mean for the future of the world? Let us view the problem from the political, the commercial, and the moral aspects. How long will the 6,000 soldiers we have in the Philippines be able to keep our flag afloat among 8,000,-

Thousands of pilgrims come every year from all parts of China to visit the shrines and temples of the sacred mountain of Hunan, Nan Yoh Shan, one of the five sacred peaks of China. Early in October more than 10,000 pilgrims arrive daily. Some of the pilgrims travel from their homes on foot, coming great distances. They kneel and bow their heads down to the little stools which they carry in their hands every five, seven, or ten steps, according to the vow they have made. At one end of the stools are many sticks of incense, the burning of which is part of their worship. In a large majority of the cases the vows have been made on behalf of a sick mother, and the journeys are taken as an expression of thanksgiving in case of recovery, or as a prayer for mercies in the other world in case of a fatal issue of the illness. The leader of the above group, who stands at the extreme left, has made annual pilgrimages for 20 years. Photo from F. A. Keller, by courtesy of "China's Millions," of Toronto.

000 of natives? How long will the 75,000 English soldiers in India be able to maintain British sovereignty over 300,000,000 of Asians? Believe me, these are not idle questions. They are up to us for an answer, whether we will or no, and upon our ability to make answer will depend the future of what we are pleased to call our Western civilization. I would not be an alarmist, and yet I would have you feel that Macauley's suggestion of the New Zealander on a broken arch of London Bridge, sketching the ruins of St. Paul, has come to be more than an extravagant figure of speech.

And I am convinced that there is real danger awaiting us unless we mend our ways. It is not the Asian who needs educating; it is the European. I am not worrying half so much about the heathen in his blindness as I am about the Christian in his blindness.

Asia is awake and preparing for the coming struggle, and we are doing very much to force the issue and to prepare her for the contest. For a century we have been sending at enormous cost our missionaries to all parts of the hemisphere to civilize. There may be doubt as to the amount of proselyting we have been able to accomplish: there can be no possible doubt of the work we have done to strengthen the Asian people politically and commercially.

A statesman of Japan said recently, in a conversation I had with him: "Your missionaries undoubtedly have done good for the morals of our people, but they have done far more for our health and strength as a nation. They come to us with doctors, and nurses, and hospitals, and schools. Before Perry's arrival 2,000,000 infants were born every year in Japan, and for lack of proper sanitary measures they died. Now, with the hospitals and sanitary and hygienic methods introduced by the missionaries, the 2,000,000 children are born, but they do not die." This is true of every other Oriental country. Meanwhile, in the countries of Europe the increase of population is slow, and, in some countries, as in France, it is hardly increasing at all. In America race suicide is becoming alarmingly prevalent.

In the recent war between Russia and Japan, Dr. Louis Seaman, who visited their field hospitals and talked freely with their army surgeons, found that the Japanese had outstripped us in almost every department of military surgery. The foreign colonies of Tokio and other Japanese cities employ native physicians in preference to Europeans.

Asia is coming into her own again. It was Asia through Arabia which gave Europe the literature, the arts, and the sciences, which we have developed and of which we now boast. Gunpowder was probably invented in China; it was certainly introduced into Europe from Arabia. The finely-tempered steel of Damascus went over from Arabia at the time of the Moorish invasion of Spain, and its manufacture was continued at Toledo. The coppersmiths of Bagdad supplied the world's market with their wonderful productions centuries before there were any industries in Europe. Weaving of silk and cotton had its birth as an industry in Arabia, and the weaving of wool was learned by the Crusaders in the same wonderful country. Astronomy, mathematics, the mariner's compass—all came to us from the Arabs.

One cannot have forgotten that the Psalms, the Gospels, and the Koran are all of Arabian origin. The inhabitants of central Arabia have today the oldest liberal government—practically a republic—on earth. And, if you go farther afield, to India, and China, and Japan, you shall find a civilization older than history and marvelous in its character. One cannot read that great library of Eastern Sacred Writings, edited by Dr. Max Müller, without being tremendously impressed.

It will not do for us to assume that ours is the only civilization. What are the basic virtues, the sum of which we call our Christian civilization? I hope we are all agreed that they are not primarily beliefs in certain theological dogmas, or certain forms of church polity,

SOME PUPILS OF THE METHODIST EPISCOPAL DAY SCHOOL, BANGALORE, SOUTH INDIA: THE BOYS' SCHOOL HAS 80, THE GIRLS' SCHOOL 50 PUPILS

or in the shape or length of priestly vestments, but in the attributes of correct Christian living. Is frugality a virtue? Your Asian far exceeds us in frugality. Is industry a merit? No people on earth work as long, as persistently, and as conscientiously as they. Is integrity esteemed? It is the unchallenged judgment of every European writer that the word of an Asian was good until they were corrupted by the inroads of Westerners. Is politeness, which is but another name for the golden rule, to be commended? Nowhere will you find such scrupulous politeness as is daily and hourly observed east of Suez.

Is observance of law desirable? The peaceable and orderly lives which the great mass of the people of Asia have led for centuries attest their habits of obedience. There are cities in India, Japan, and China with crowded populations running from a hundred thousand into the millions where there is scarcely the semblance of police control, and where crime is hardly known. They are a calm, thoughtful people, to whom what Mr Arthur Benson has so well called "the gospel of push," and what our own vigorous Roosevelt calls a "strenuous life," is unknown. But I am not at all sure that this is an unmixed evil, for there are no "brain-storms" there, and neurasthenia is provided for nowhere. In the light of the fact that the number of inmates in the insane hospitals of our country doubled in six years, according to the latest available statistics, I cannot but feel that we need less strenuosity rather than more. Compared with Western civilization, theirs will not suffer perhaps as much as you would imagine; and perhaps you will agree that the chief characteristics of our civilization are push and extravagance, and that in this respect they have the better of us.

All this brings me to my topic. And I must say that, paraphrasing Mr Lincoln's words at Gettysburg, in large measure it is not for us to educate, but to be educated. We shall never meet the problems growing out of our relation with the Far East unless we absolutely and once for all put away race prejudice. I believe the European snob in Asia is distinctly the enemy of the civilized West. And his coadjutor in this country is a fitting criminal yoke-fellow. Let me give you some illustrations of what I mean—cases which came under my personal observation. From Bombay to Yokohama there is not a social club at any port or treaty point where a native, whatever his culture or refinement, will be admitted.

At the Bengal Club at Calcutta last year a member in perfectly good standing innocently invited a Eurasian gentleman—that is, one who is half native and half European—to dine with him. It became known that the invitation had been extended, and a storm of opposition broke among the members. The matter was finally adjusted by setting aside the ladies' department of the club, and there the offending member and his unfortunate guest dined alone. The next day the member was called before the board of governors and notified that another like breach of the rules would result in his expulsion.

The beating of native servants and workmen in India is a daily and hourly occurrence. It formerly was so at Hongkong and Shanghai, but Mr Sprague, the representative of the Standard Oil Company at Shanghai, told me that since the Russo-Japanese war the natives would not stand it, and that all beating of them by Europeans in that city had ceased.

While in Calcutta I attended a ball at Government House, and noted that while one or two native princesses were on the floor dancing with white men, there were twenty or more native gentlemen standing about as "wall flowers." I called the attention of Lady Minto to the fact, and she explained that no white woman would think of dancing with a native; it would certainly result in ostracism.

The son of a maharaja goes to England, is educated at Oxford or Cambridge, is lionized in the West End of London—mayhap he is honored with an

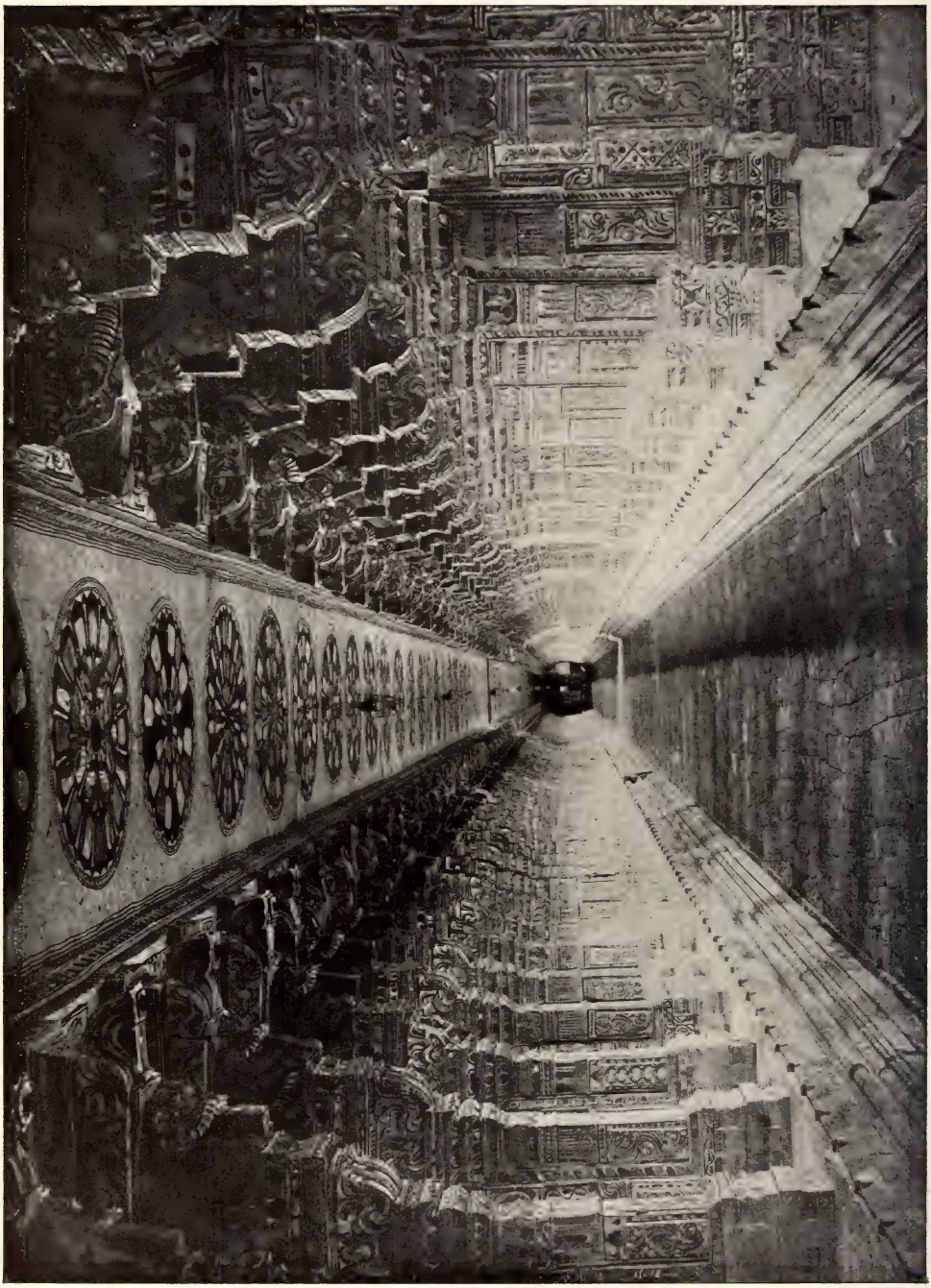


Photo by courtesy of New York Times

THE INTERIOR CLOISTER OF AN ANCIENT HINDU TEMPLE OF INDIA

invitation to Windsor. When he goes back home he may enter no white man's club; if he be fortunate enough to be invited to a white man's function, no white woman will dance or associate with him, and if by any luck he should marry a European, he, his wife, and his children become outcasts.

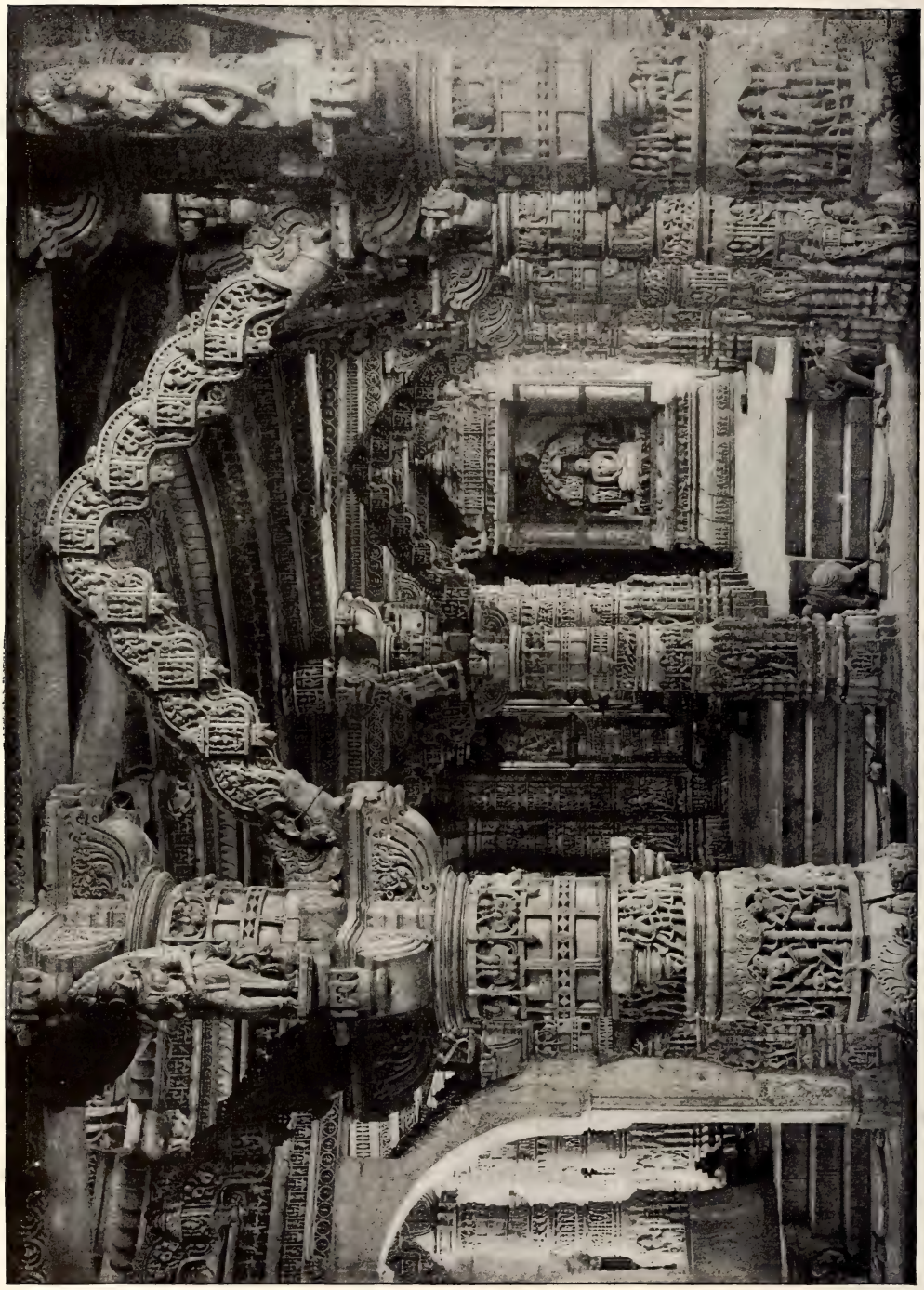
Although native troops, like the Sikhs, have shown undying loyalty to the British flag, and on frequent occasions have exhibited courage in the highest degree, no one of them ever has or ever can achieve the Victoria Cross.

I have no thought, in saying this, of criticising British rule in India. I do not question that it has been of enormous benefit. Neither do I doubt that under the administration of Lord Morley there is the most sincere desire to do all for India that the cause of humanity or Christianity may dictate. And I am also quite ready to say that the problem is a difficult one; that "the white man's burden" is one not easy to bear. I know that attempts to do justice are often misunderstood by the natives, are construed as evidence of fear. I know that the Bengalis, who are responsible for most of the unrest in India, are a silly lot, whose lives and property would not be worth a groat were British protection withdrawn. I know that the beneficent British supremacy has been made possible only by the religious divisions among the natives. But this is all the more reason why the greatest care should be exercised not alone in India, but throughout Asia, why the line of cleavage should not be permitted to pass from a religious to a racial one, and the danger that it may do so grows with every hour.

On the one hand, there is a very perceptible loosening of the bonds of religious caste; not infrequently today high-class Brahmins not only shake hands with Moslems and Christians, but even sit at table and eat meat with them. On the other hand, there was startling evidence during the recent war of the secret racial tie that binds all Asia. We are accustomed to think and speak of India as a British possession, forgetting that after all only five-eighths of its area is British, while there are over 600 native princes and chiefs, each governing a state, which is more or less independent. Some of these princes are enormously wealthy. So far as they have any religious bent, they are Hindu, or Mahratta, and in this respect not at all at one with the Japanese, who are either Shinto or Buddhist. Yet while the war was on, it was not uncommon for a rich Maharaja to call at Government House and ask if it would be regarded as an unfriendly act for him to buy Japanese bonds. Of course, the viceroy was forced to say it would not, since Britain and Japan were in treaty alliance. Of course, these investments were made through London banks, and the extent of the transactions will never be known. We do know, however, that there was a mysterious absorption of Japanese securities, which never could be accounted for by either the London financiers or our own.

What I feel is that the danger of Asiatic ethnic solidarity is immensely accentuated by the attitude of certain of the British themselves. It goes without saying that the younger son of a British nobleman, who does not succeed to his father's estate and does not go into trade, but who finds the only outlet for his activities in the army or navy, the church, or in the Indian civil service, becomes far more of a snob, and therefore far more of a danger when dealing with natives in Asia than he would be permitted to be at home in England. And the harm that one such person can do it may take an army to undo.

I have spoken thus freely respecting the conditions in India because I feel at liberty to do so, since my mother was born under the British flag, and I have a very large number of relatives in the British army, navy, and church. But I should be wholly lacking in fairness if I did not ask your attention to similar cases of race prejudice in which we are



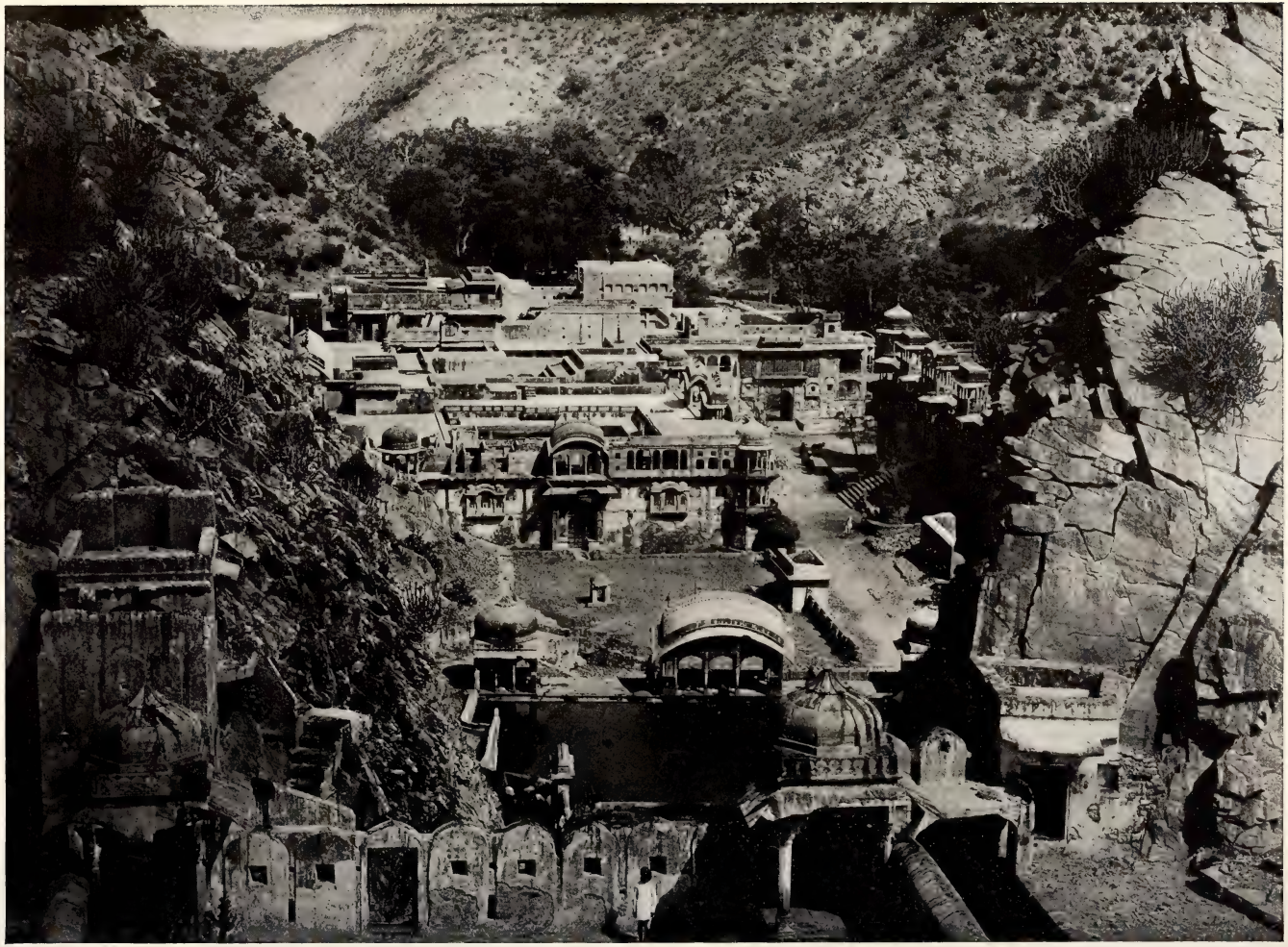
INTERIOR OF THE JAIN TEMPLE AT DILAWAR

Photo by courtesy of New York Times

Photo by courtesy of New York Times

THE CARVED CEILING OF THE JAIN TEMPLE AT DILAWAR

Jainism is an important sect of the Hindus, claiming no less than a million believers. This religion arose as a protest against Brahmanism about the same time as did Buddhism. Unlike the latter, however, it never spread beyond the bounds of India. The Jains are among the wealthiest and most influential members of the Hindu community, devoting their energies largely to mercantile pursuits.



TEMPLES AND TOMBS AT JEYPORE

Jeypore, perhaps the handsomest of the native towns of India, lies about 850 miles northwest of Calcutta. The city was founded in 1728 and is surrounded by a formidable wall. It has paved streets 111 feet wide, running at right angles to

involved and which are equally dangerous in other parts of Asia.

Let me tell you a story as it was told me by a Harvard graduate, who is now a minister of the Japanese Crown. "When Perry came here," said he, "and Townsend Harris (of blessed memory) followed him and made the first treaty with Japan, it was stipulated that we (the Japanese) should give them ground for their legation and their consulates, compounds. We did so. Yokohama was then an unimportant place, a native fishing village. It was the natural port of Tokio, but as we had no foreign trade that meant nothing. We gave them ground in Yokohama for their consulate. Merchants and traders followed, and we gave them ground also for their shops. The British and the Russians and other European nations came in and we gave them like concessions. In Yokohama, as you know, houses and stores are not numbered as you number them in America—110 Broadway, for instance—but are numbered in the order in which they were built. Thus, "Number 1 Yokohama" may be half a mile distant from "Number 2 Yokohama." This method of numbering still survives.

"Well, as time went on the village grew into a city. Under the treaty of Townsend Harris and all the other treaties the right of extra-territoriality was recognized. That is, whenever a case arose in which a foreigner was involved it must be tried by the consul of the country to which the foreigner belonged. As time went on, Sir Harry Parks, the British minister, asked for ground in Yokohama for a race-track. We cautiously suggested that horse-racing was said to be wicked by the European missionaries. But he insisted and we gave him the ground. Then we were asked for ground for a social club for the foreigners, and we gave them a plot on the sea front, the finest piece of land in the city.

"Later they wanted to play cricket and football, and finally golf. Well, we gave them ground for this. As the city grew, this cricket-field was so surrounded by buildings that it was practically in the center of town. Understand, all of this ground was donated. Last year we suggested that we could use the cricket-field, and we offered to give in place of it a field in the suburbs. As railways had been built meanwhile, the new field would be even more accessible than the old one was when we gave it. The foreigners demurred, and proposed that we buy the old field and with the purchase-money they would secure a new one. Finally, we compromised by paying for their improvements and furnishing them a new field with like improvements free of cost.

"The question of taxation arose. Yokohama had grown to be a city of 300,000 inhabitants, with millions of dollars invested in buildings owned by foreigners. We asked no taxes on the ground we had donated to them, but we did think it fair that they should pay taxes on their buildings. They said no, that everywhere in the West the buildings went with the ground. We submitted the question to the Americans, but they dodged the issue, saying they would do whatever the others did. Then, under the law of extra-territoriality, we were compelled to leave the decision to the British consul, and he decided against us. The case has now gone to The Hague Court.

"Finally, when I tell you that in the light of this history no native Japanese gentleman has ever been permitted to enter the club-house or the grand-stand of the race-track or to play upon the cricket-field, perhaps you will understand why there is some feeling against foreigners in Yokohama."

When Commodore Perry went to Japan in 1853 he wrote a letter to the Japanese Emperor containing these words:

"With the Americans, as indeed with all Christian people, it is considered a sacred duty to receive with kindness, and to succor and protect all, of whatever nation, who may be cast upon their

shores, and such has been the course of the Americans with all Japanese subjects who have fallen under their protection."

With his warships Perry compelled Japan to receive citizens of the United States and to grant them extraordinary domiciliary rights. From that day to this we have spent enormous sums to establish schools in Japan for the education of the natives. Yet we now are seeking to deny them admission to this country and we are refusing to permit them to attend our schools.

In the Philippines a ruffian American soldier, recruited from the purlieus of New York, shoves a native gentleman from the sidewalk of Manila with an oath, calling him a "nigger." Yet that "nigger" is very likely a cultivated gentleman, educated at the Sorbonne, in Paris.

The infamous opium war upon China, and the equally infamous existent compulsion of China to receive Indian opium, are outrages no whit worse than our own extortion of absurdly exorbitant damages for losses of American ships to Chinese pirates in the Yellow Sea. For many years there was no more profitable undertaking for the owner of an American clipper ship than to sell it and its cargo to the Chinese government after it had been looted by the pirates.

Such, my friends, is something of the shameful record of our relations with the Far East. In India, in China, and in Japan we have been the guests who have enjoyed their hospitality, only to rise in the morning and say to our hosts, "You must not sit at table with us." Believe me, this condition cannot endure. Politically we are in grave danger. Commercially, with their industry and their frugality, they are fast outstripping us.

They have ceased buying flour from the Minneapolis mills, because they are grinding Indian and Manchurian wheat with Chinese labor at Woosung. A line of ships is running from the Yellow River to Seattle, bringing 72,000 tons a year of pig iron manufactured at Hankow, and delivered, freight and duty added, cheaper than we can produce it. In Cawnpore, India, with American machinery they are making shoes so cheaply that the manufacturers of Lynn can no longer compete with them. The cottons and silks which we one time sent from here to Asia are now made in Japan and China.

Thus are we related to them politically and commercially. Socially they are all saying to us, "Stop cheating us; stop swindling us; stop your treating us as your inferiors who are to be beaten and robbed." Japan is crying out, "Treat us fairly and we will go more than half way. Leave to us the question whether Japanese laborers shall go to America to annoy you, and we will stop them. But do not say that you will admit the lazaroni of Hungary and Italy and Russia, simply because they are white, and shut us out because we are yellow.

The Singhalese natives of Ceylon, while I was in Colombo, addressed a remarkable communication to the Governor General. They said a hundred years ago there was established in the United States a new theory of government—that there should be no taxation without representation. "Now," said they, "we ask a share in the government of the island. We pay taxes. You may fix a property qualification and say that no one having less than a thousand pounds sterling shall share in the government. We shall not object. You may also fix an educational qualification. You may say that no one but a college graduate shall take part in the government. We will not object. In short, you may fix any qualification except a racial qualification. That would not be fair." "And what answer have you to make?" I asked Mr Crosby Rolles, editor of *The Times,* of Ceylon. "To meet their request," he replied, "would mean to turn over the government of Ceylon to them at once, because there are 6,000 of them and only 5,000 English men, women, and children. We must stop educating them."

What do you think of that for a remedy? Personally, I do not think it will work, any more than I think any rule of arbitrary repression can endure.

I take refuge in the large experience and ripe judgment of Lord Curzon, of Kedleston, who in July, 1904, was given the freedom of the city of London in Guildhall, and on that occasion used these words: "Depend upon it, you will never rule the East except through the heart, and the moment imagination has gone out of your Asiatic policy your empire will dwindle and decay."

I am also impressed with the correctness of Lord Morley's attitude. Speaking in support of the Indian reform proposals two years ago, he said: "The Founder of Christianity arose in an Oriental country, and, when I am told that Orientals always mistake kindness for fear, I must repeat that I do not believe it, any more than I believe the stranger saying of Carlyle, that after all the fundamental question between any two beings is, Can I kill thee, or canst thou kill me? I do not agree that any organized society has ever subsisted upon either of those principles, or that brutality is always present as a fundamental postulate in the relations between rulers and ruled."

And Curzon and Morley have many supporters in their view. In smug complacency, you may close your doors which look toward Asia, while you open wide those which look toward Europe; you may refuse the Oriental admission to your schools, while you accord the privilege to any child of a European; you may pile import duties mountain high, and raise our standards of living to any pitch of extravagance; you may build warships without limit, and you may continue to treat the Asian as legitimate prey. But I am confident that it will not avail.

As a soldier, whether at Omdurman, in the Sudan, or on 203-Metre Hill, at Port Arthur, the man of color has shown himself a right good fighting man; in commerce he has, by his industry, perseverance, ingenuity, and frugality, given us pause; and before the eternal throne his temporal and his spiritual welfare are worth as much as yours or mine.

SOME MEXICAN TRANSPORTATION SCENES

By Walter W. Bradley

With Photographs by the Author

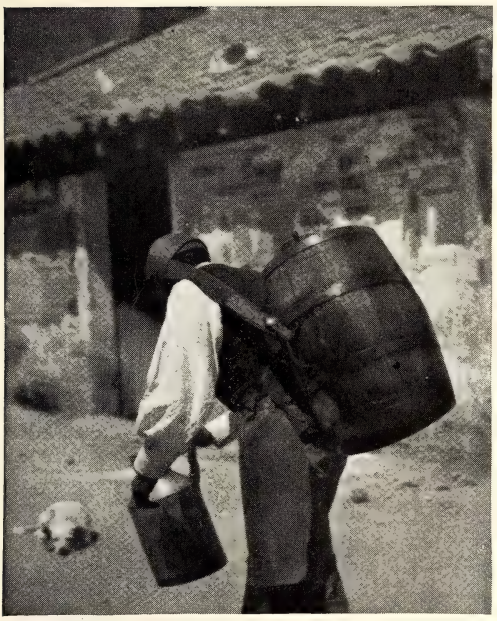
IN Mexico one may find all of the modern conveniences of travel and transport, including the Pullman, automobiles, and electric street railways; for, in Mexico City, the capital of our sister Republic, they have quite as complete and effective a street and suburban system of electric railways as is to be found in any city of the United States. While this is true, it is not the intention of the present sketch to describe any of the above modes of travel; but rather to depict some less familiar scenes, which are in part at least the relic of earlier days.

The contrast seen in these ancient and modern methods side by side is striking, at times. The writer one day on the outskirts of Mexico City while riding on an electric car passed a "peon" (laborer) carrying on his shoulder a wooden plow, such as we read of as in use in Palestine in the time of Christ. Picture 1 shows burros packing straw through the streets of the city, and was taken while passing in front of the cathedral, which fronts on the main plaza. The electric street-car tracks may be noted in the foreground.

Picture 2 illustrates the use of oxen for motive power in transportation. The Mexicans do not use a shoulder yoke for oxen, but a single stick of timber is lashed with heavy leather thongs to the

PICTURE 1. BURROS CARRYING STRAW: MEXICO CITY (SEE PAGE 985)

PICTURE 2. OX CART AT SINALOA



PICTURE 3. THE WATER VENDER

back of the animal's horns. Sometimes the yoke of the wheel span is lashed rigidly to the timber projecting from the cart; and at each roll and jolt of the cart over the rough mountain roads the poor brutes' heads are yanked and jerked to first one side and then the other.

Picture 3 is of an "aguador" (water vender), at Cuernavaca, capital of the State of Morelos, one time home of Cortés and Maximilian. The can in front of him, used for serving the water from the barrel, is also hung by a strap from his head. The Mexican peon is rarely seen carrying even the smallest package in his hands—he must hang it from his head or shoulders, or stow it inside the high crown of his "sombrero" (as in the case of small parcels). The writer has seen a peon buy a centavo or two of peanuts from a street vender, take them, loose, in his hands and toss them into the broad, turned-up brim of his hat, and stroll off down the street.

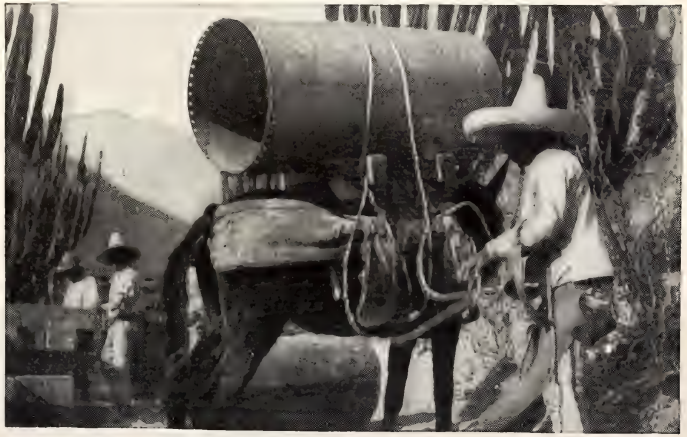
In Picture 5 may be seen another method of carrying water. The two men shown in Picture 4 have crates which are used to take farm produce and poultry to market. They have disposed of their loads in the city and are seen entering the Church of "Nuestra Senora de Guadalupe" (Our Lady of Guadalupe), the shrine of the patron saint of Mexico at Guadalupe.

The ancient method of hoisting ore in the Mexican mines was by means of the leather bag ("zurron"), one of which may be seen in Pic. 8. Though all of the larger mines are now equipped with modern machinery, the zurron may still be seen in small properties and in districts remote from the railroads. Often the zurroneros were mere boys; but they would carry their loads of 100 to 200 pounds up winzes and shafts, with only the precarious footing afforded by the "chicken-ladders" (notched poles four to six inches in diameter).

PICTURE 4. CRATES USED FOR CARRYING CHICKENS TO MARKET

PICTURE 5. WATER CARRIERS, SAN BLAS, SINALOA

PICTURE 6. TRANSPORTING A SHAFT WEIGHING 580 POUNDS TO THE CYANIDE PLANT



PICTURE 7. TRANSPORTING A JOINT OF PRESSURE PIPE FOR HYDRO-ELECTRIC POWER PLANT. WEIGHT, 396 POUNDS

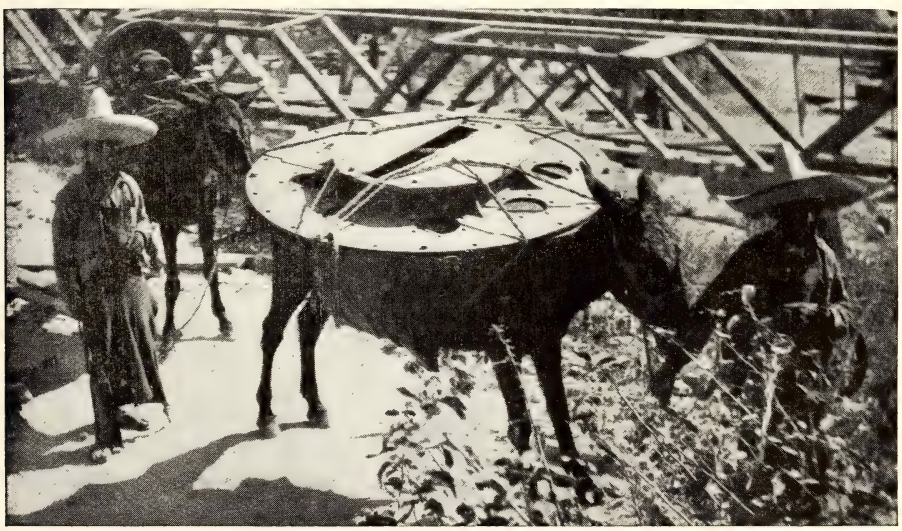
The mule-back method of transporting sectionalized mining machinery is not an unfamiliar sight in the mountain districts of the western United States; but some of the loads handled in this way by the Ventanas Mining and Exploration Co. (Ltd.), in western Durango, Mexico (with which the writer was assistant manager), are worthy of illustration.

The "time-honored" mule load was 300 to 350 pounds—a "carga" consisting of two pieces or packages weighing about 150 pounds apiece, one being lashed on either side of the pack saddle. A "cuarteo" is a box or single piece, which by reason of bulk or weight can only be handled singly. In sixteen months we took into Ventanas, over 105 miles of rough mountain trails, some 1,500 tons of heavy, awkward machinery and 1,000 tons of stores and supplies. Every ounce of this went in on either mule or burro back.

It is possible, by exercising judgment in assigning loads best suited to certain animals, to handle over rough trails loads of 475 to 500 pounds, and when necessary as much as 680 pounds, in one piece.

Picture 6 shows a piece of shafting 3 15-16 inches diameter, 13 feet 6 inches long and weighing 580 pounds. Thirteen of these shafts were thus transported to the mine on picked mules, two men being

PICTURE 8. THE ANCIENT BURDEN BEARER IN THE MINES



PICTURE 9. TRANSPORTING BY MULE TRAIN: MEXICO

PICTURE 10. CARRYING 2,300 FEET OF ⅞ STEEL AËRIAL TRAMWAY CABLE ON 12 MULES (SEE PAGE 990)

assigned to each mule—one man ahead with the lead-rope, the other behind to steady the load and prevent it from swinging and see-sawing. Heavy pieces like these were handled in relays, changing mules about every two hours.

The method of handling cables is shown in Picture 10, which is of 2,300 feet of seven-eighths-inch steel aërial tramway cable on 12 mules. "The coils were made up and tied with wire in the factory before shipping, each mule-load being divided into two parts, with about 12 feet of cable between each pair of coils. The coils were so arranged that each mule-load was about 236 pounds or 144 feet of one-inch, 230 pounds or 192 feet of seven-eighths-inch, 240 pounds or 354 feet of five-eighths-inch cable. The largest piece (about 4,000 feet) of one-inch cable required 26 mules for its transport. One man was assigned to each two mules. The mule at the head of the line was controlled by a lead-rope, and each mule's lead-rope was fastened to the pack of the mule in front of it. In this way they were kept at a uniform pace, and with the men distributed as indicated the entire train could be stopped simultaneously when necessary to tighten up the cinches or for other purposes."*

Picture 9 shows a tube-mill head-plate casting (in the lead), weight 200 pounds, and a tube-mill roller bearing, 385 pounds. The latter was an awkward piece to handle, not so much due to its weight as that it rested high on the "lomillos," a small wooden crib made of four 4 by 4-inch blocks, which rests

*"Mule-Back Transportation of Sectionalized Machinery," by F. C. Robert and Walter W. Bradley, Mining and Scientific Press, May 29, 1909.

on top of the saddle. A joint of one-fourth-inch gauge, 26 inches diameter, pressure pipe (weight 396 pounds) for the hydro-electric plant is shown in Picture 8.

A total of 600,000 feet B. M. of lumber was packed from saw-mill to mine (3 days' round trip) on burros and mules. The burros handled the lighter stuff—1 by 12 inches, 2 by 4, and 4 by 4. Each mule carried from 88 feet B. M. (2 pieces of 6 by 8 inches by 11 feet) up to 117 feet B. M. (2 pieces of 8 by 8 inches by 11 feet). Two pieces of 8 by 8 inches by 11 feet would weigh from 350 to 400 pounds, depending on the extent they had been seasoned, while a few very pitchy sticks, which were actually weighed, tipped the scales at 620 pounds for the pair.

THE ISTHMUS OF TEHUANTEPEC

"The Bridge of the World's Commerce"

By Helen Olsson-Seffer

THE advantages of the Isthmus of Tehuantepec as a line of communication between the two largest oceans of the world seem to have appealed to the minds of travelers and explorers from the very earliest times. Hernan Cortez predicted that it would become the great transcontinental highway. Alexander von Humboldt, who traveled in Mexico in the beginning of the last century, called the isthmus "the bridge of the world's commerce."

Nearly half a century ago the first attempts were made to dig a canal, and many railroad schemes were proposed from time to time. The first work was undertaken by the Mexican government in 1882, but it was not until 1907 that the Tehuantepec Railroad was formally opened, after a succession of failures and after years of unremitting labor.

The road, as it now exists, is in excellent condition, and bids fair to become a formidable rival to the future Panama Canal. With good harbors at each end of the road, with modern and labor-saving machinery and appliances for loading freight, and with regular communication across the oceans, the isthmus route offers great advantages to commerce. It shortens the distance between the East and West by several days.

While the route via Cape Horn from New York to Yokohama is 19,802 miles, that via Cape of Good Hope 18,085 miles, via the Suez Canal 15,527 miles, and via the Panama Railroad 11,256 miles, the distance via the Isthmus of Tehuantepec is only 10,006 miles. This latter route makes the distance from New York to Honolulu 1,273 miles shorter than the Isthmus of Panama route. At the present day, when rapid transportation is of primary importance, such a saving of time is an item worth consideration.

RIVER OF THE WINDING SNAKE

Before the days of the pioneer and forest roads, the Coatzacoalcos River (the River of the Winding Snake), emptying into the Gulf of Mexico, was the favored highway, and dug-outs poled by dusky natives carried freight and a few passengers up and down the river and its tributaries. Here and there a narrow mule-path trailing away from the banks of the river marked the entrance to some lonely plantation or village. To-day, however, the new stands side by side with the old. Fine steel boats run on the river, but the native still poles up and down in his dug-out canoe. Good roads and mule-paths have been made

NATIVE DUG-OUT CANOES AT TEHUANTEPEC, MEXICO

Photo from Russell Hastings Millward

from one plantation to another, but the old-time ox carts have not yet been discarded.

The town of Coatzacoalcos, at the mouth of the great river, has undergone the greatest change. Once a veritable fever hole, it is now rapidly being modernized and brought into some semblance of sanitation. Long wharves jut out from the water front, and fireproof warehouses and electric cranes give to the town a business-like appearance.

About this river, the Winding Snake, is woven a curious folk-legend, which explains to the native mind the origin of the tree called the *Rabo de Lagarto,* or the alligator's tail, which tree is very often seen in that part of the country.

This legend runs thus:

Many years before man was seen upon this earth, alligators in great numbers made their homes on the banks of the River of the Winding Snake, whiling away the time in sunning and warming themselves.

The young alligators often grew restless and curious of what lay beyond, over in the woods where the monkeys and parrots chattered and the great cats wandered about. "How wide is the forest?" and "Where do the paths lead to that wind away into the woods?" were questions they were continually asking each other.

One day, while the young alligators were sunning themselves on the bank, two very strange creatures came walking by and stopped to rest near the root of a big tree. One said to the other, "Do look at those alligators. They are exactly like the alligators on the other side of the mountains, and there the foolish people believe them to be gods and feed and care for them until they grow so big and fat that they can hardly move."

With that they moved along, leaving great excitement behind them in the river, for the young alligators were resolved to seek their fortunes on the other side of the mountains. Paying no heed to the warnings of their elders, they met at a certain bend of the river the following morning and set out swimming all day up stream. When night came they were so tired that they crept out from the river to sleep among the marsh weeds. Sleeping soundly, they did not hear the water gods who suddenly came upon them. These water gods were friends of the alligators, and had warned them long ago that they must never leave their homes. So, finding that they had been disobeyed, they summoned the spirit of the hills and commanded him to take the wanderers far into the forest and leave them standing on their heads. There they can be seen to this day turned into living trees. As time went on and the little alligators did not return to their home, the old ones lost hope and began to weep, shedding so many alligator tears that the mouth of the Coatzacoalcos River has ever since been salty.

The "salty mouth" of the Coatzacoalcos, with a width of some 2,000 feet, forms a good natural harbor, and has been turned into the Atlantic port for the isthmus railroad.

ALONG THE ISTHMUS ROUTE

From Coatzacoalcos the road gradually begins to climb the Cordillera, which divides the Gulf slope from that of the Pacific. Much of the route lies through wild and beautiful country, with tall *manaca* palms (*Attalea cohune*) and forest trees topping a thickly matted jungle, and here and there a quaint little Indian village on the banks of a shaded, shallow river. The picturesque Malatengo Cañon, with its rocky chasms, is followed by the Chivela Pass, entered at a height of 735 feet above sea-level, the highest point on the isthmus.

Looking up from the bottom of this wild cañon, the walls appear almost to meet, and only a narrow strip of blue sky can be seen far above. Some days, when the Gulf wind drives the ocean clouds overhead, the cañon seems filled with mist and gloom. It is then that the wild legends and romantic tales that the Indians still tell of this region linger in one's mind.

Leaving the pass, the train crawls down the Pacific slope of the Sierra

THE TOWN OF SAN GERONIMO, ON THE TEHUANTEPEC RAILROAD, A SHORT DISTANCE FROM THE PACIFIC END OF THE LINE

Madre, running along for some distance by the banks of the Rio de Tehuantepec, then cutting off across country to Salina Cruz, the Pacific port.

Here the little Indian village of years ago has given place to a new town, built on higher ground and dotted here and there with comfortable bungalows, the homes of English residents.

Fierce "northers" rage on the isthmus the greater part of the year, and the long swell of the Pacific causes a heavy surf. As no natural shelter exists, it was found necessary to build one—an outer refuge harbor, and an inner harbor with dry-dock and wharves. This dry-dock, one of the finest in the world, and the wharves, steel warehouses, and gigantic cranes make a most up-to-date port.

It is difficult to realize the immensity of the work accomplished on the isthmus. Less than six years ago the conditions were very bad; fever and death or shattered health lurked in the forest, and heavy tropical rains destroyed in a few hours the labor of days. To one who has lived and traveled in these tropics before the advent of the steam horse, it is an odd sensation to enter a comfortable Pullman car and be rushed smoothly through the primeval tropical forest at the rate of 50 miles an hour. Humble natives with burdens on their backs stand staring at this monstrosity, which with a warning screech flashes by.

The country through which the railway runs is in many respects of great interest. The tropical nature, the many different tribes of Indians living along the rivers and in the hills, their peculiar customs and picturesque garb furnish an interesting study.

DESCENDANTS OF ONCE-POWERFUL TRIBES

The different Indians today inhabiting the isthmus, descendants of once-powerful tribes, still show enough distinctive characteristics to enable one to judge of their ancestors. The Agualulcos, Aztecs, Huaves, Mijes, Zapotecos, and Zoques are among these.

The Agualulcos and Aztecs dwell in the northern part of the isthmus. Though outwardly conforming to the Catholic religion, they still retain many of their old customs and superstitions.

Among these Indians the memory of Doña Marina, or Malinche, as the Indians called her, is still revered. Although acting as interpreter and guide to Cortez, she seems to have been greatly beloved by the Indians. In Jaltipan, her native village, there is an artificial mound about 40 feet high, called the "Hill of Malinche," and the natives, who still believe that Malinche is buried beneath this hill, contend that some day her spirit will return to sweep away the cloud that has hung over them since the Conquest.

The Mijes live in the mountains to the west, in the town of San Juan Guichicovi. They are exceedingly ignorant, bold, and rather repulsive in appearance. History classes them as having been at one time the most brutal and idolatrous of all the isthmus tribes.

The greatest ambition of a Mije is to possess more mules than his neighbor. Just why is hard to understand, as they prefer to carry their burdens on their own back.

They get good crops of maize, beans, and rice from their *milpas*, which are well taken care of, but they work fitfully, are great drunkards, and very dishonest.

The Zoques, who live in the mountains between the Chichijapa Valley and the Rio del Corte, are, like the Mijes, very fond of *tequila*, the native alcohol, but more industrious, and of a more pleasing appearance.

The Huave tribe, now dwindled to a thousand or two, live in a few towns on the Pacific coast. They are very different from the other tribes, and claim to be descended from a powerful tribe in Peru.

The Zapotecos, who inhabit the greater part of the southern division of the isthmus, are hard working, gentle, and intelligent, and at one time were a highly cultured nation.

The various Indian languages are now little else than ill-spoken dialects

THE BIG TREE AT TULE, IN THE STATE OF OAXACA (SEE PAGE 1007) Photo from Russell Hastings Millward

NATIVE LABORERS Photo from Russell Hastings Millward

pieced out with Spanish words and sentences.

Somewhat below medium height, the Indians possess unusual muscular strength. They are often able to carry for several hours on their shoulders, under the rays of the tropical sun, cargoes weighing from 100 to 200 pounds. Deformed Indians among the isthmus tribes are very unusual. Their habits are exceedingly simple and their senses unusually acute, especially that of sight.

They still cling to their ancient mode of tilling the land with their primitive wooden plows. Foreign commerce, example—nothing has been able to shake their belief in the idea that their way is good enough.

The women are gracefully built, and in some tribes remarkably beautiful. With the exception of the Zapotecos, there is nothing unusual in the costume of these natives. They are garbed according to the climate, the women in heavy or light weight *cortes* and a chemise; the men in once-white cotton trousers and a shirt of the same material, with a *zarape*, if the weather be cool.

The mountain Indians wear an odd raincoat, much like the raincoat used by the Japanese peasant, made of plaited straw. These coats seem to shed the rain quite as well as our modern macintoshes, and certainly are much more picturesque.

TEHUANTEPEC, "THE HILL OF THE TIGER"

Tehuantepec is one of the important towns of the isthmus, and is mainly inhabited by Zapotecos. Its market place, "El Centro Mercantil," is always full of interest. Women of all ages sit here; tiny girls, exact miniatures of their mothers, play about.

From early morning the long, red-

tiled shed is the center of attraction. Women, children, pigs and dogs, baskets of flowers—the heavily scented gardenia and masses of pink geranium—imitation coral beads, hideous iguanas, *dulces* of many kinds, bananas and other tropical fruits—all lend themselves to the making of a scene at once picturesque and novel.

PICTURESQUE COSTUMES

The Tehuana women are beautiful. Their stately carriage, regular features, and beautiful soft brown eyes, added to their fascinating costumes, mark them with distinction and irresistible charm. They wear the usual Indian *corte,* or *enagua derollada* (rolled skirt), which is nothing more nor less than a straight piece of cotton cloth, generally one meter wide and two meters long, dyed red, blue, purple, or a checked red and white; a short chemise, or *coton,* sleeveless and with a low neck, coming just to the waist line. It is made of cotton material in different colors or of velvet, and shows to great advantage the tawny, perfectly formed arms and shoulders. The crowning touch, however, is their head-dress. Shaped somewhat like a short Japanese kimono, with a wide flounce of starched and pleated white cotton lace, it is thrown over the head so that the stiffened, lacey flounce stands out about the face like a fan-shaped frame. The rest of the garment, alas! hangs ignominiously down the back.

The more wealthy Tehuanas have a great quantity of jewelry—necklaces long enough to wind two or three times about the neck, falling down to the waist, and usually made of United States five-dollar gold pieces, alternating with irregularly shaped pearls, are the most favored. A small pendant, called *palometa,* or little dove, made of gold, and somewhat resembling the wings of a dove, often of very fine workmanship and set with pearls, is worn by almost all Tehuana women, either suspended by a bit of dirty string about the neck or a string of imitation coral beads.

Instead of baskets, the women use large calabashes, which are dried and painted, some in vivid green with gaudy flowers trailing over them, others in red, and still others in yellow. These calabashes, called "*jícaras,*" filled with fruit or other products, they balance on their heads as they walk.

NATIVE HANDICRAFT

During one of my visits to Tehuantepec, I had a lively chat with an elderly Tehuana, whose waving white hair, drawn gently back from her forehead, made a fitting frame for her regular, cameo-like features. She had come over to the market, she said, to look after the girl who was selling the cortes; she did not make much money now in the weaving and dyeing business, it was so hard to get cheap labor; times had changed greatly since she had begun her work. Noticing my interest in the cortes she had for sale, she offered to show me her home, and I followed her down the cobble-stoned street and turned into the arched doorway of a substantial adobe house, evidently quite an old place, square and one-storied, with a large brick *patio* in the center. Here in the *patio* was her work-shop.

Three young men were lazily dipping pieces of cotton cloth into large caldrons of a dark blue dye, the *anil cimarron* of the Indians (*Indigofera anil*). After soaking a sufficient time the cloth was taken out and hung on a line to dry, and, when dried and pressed, was ready for the market. This indigo coloring is made in a very simple way. Branches of the *Indigofera* are boiled down in vats until the water is thoroughly colored with the dye. It is then left to settle, the solid part of the dye sinking to the bottom of the vat. The water is drawn off and the deposit is left in the sun to dry and harden. The blue *cortes* are very commonly worn, and can be bought for from three to six pesos.

THE ROYAL PURPLE

In a room off the *patio* two men were sitting before large, old-fashioned looms weaving the much-prized purple *cortes.* Each *corte* of this purple color costs the

Photo from Mrs H. Olsson-Seffer

A TEHUANTEPEC GIRL IN HER BALL GOWN

A DANCE DURING A FIESTA IN TEHUANTEPEC

Photo from Mrs H. Olsson-Seffer

enormous sum of 20 pesos. The manner in which the thread is dyed is in itself costly and tedious, and, when woven, is well worth the price.

There is a little cove on the Pacific coast, about two days distant from Tehuantepec, where the Huave Indians go laden with skeins of coarse thread. Here they wait until the tide is far out and then paddle off in little boats to a group of rocks some distance from the shore. These rocks are covered with a certain species of small mollusks, *Aplysia depilans,* clinging fast to the rocks. The men quickly pry off and blow into the little shells, whereupon a milky, acrid, and ill-smelling fluid exudes from the animal. When they have collected enough of this fluid the thread is thoroughly wet with it and left in a sunny place on the beach to dry, subsequently being washed with soap and water, when it turns into a beautiful and permanent violet color. The Indians insist that this process keeps the thread from rotting. The men are very gentle in handling these shells, carefully replacing them on the rocks after their work is done. This mollusk is closely related to the *Lepus marinus* of the ancients, which history tells us furnished the purple of vaunted Tyre.

My hostess next took us into her kitchen and showed us her bake oven, which looked more like an Eskimo hut than anything I can think of. It was very large, all of four and a half feet high, round, and made of clay, with a large door in one side. A spotted pig with an inquiring turn of mind kept close to my heels during my stay in the kitchen, and two brown hens pecked around as if very much at home.

The parlor came next, a very neat, well-kept room, and one in which our hostess evidently took much pride. There was an upholstered sofa and two chairs, an elaborate "what-not" in the corner, covered with fancy fans and gay colored picture cards, and two or three ordinary cane-bottomed chairs. We sat down here while she showed a number of native ball costumes. These are very elaborate, especially the skirts, which are either of brocaded velvet or of plush, often with very intricate patterns of embroidery and beads. These skirts are all made in one style, very scanty, and gathered on to a band for the waist. Without exception they are finished at the foot with a pleated ruffle of stiffly starched white cotton lace about 10 inches wide. These costumes seem to be peculiar to Tehuantepec, and, though seen sometimes at Salina Cruz and San Geronimo, are only worn by the Tehuanas.

MARKS OF AN OLDER CIVILIZATION

There are many points of interest to be seen round about Tehuantepec. In a northeasterly direction, about three miles from the town of San Geronimo, is a curious painted rock standing straight up from the sloping side of the Cerro de Ixtaltepec. It is covered with quaint figures and hieroglyphics painted in red, and, though very old, these figures are still quite distinct. It is thought by some to have been a treaty rock, probably settling some dispute between two tribes in the days before the conquest. The Indians do not like to go near the rock, fearing the evil spirits that abound there. Several bright red crosses have been painted over the figures in recent years, evidently work done by the padres to drive the devils away.

A number of ruins, silent evidences of a once vast and powerful people, have been brought to light from time to time. One, a very interesting study, the mountain of Guihengola, whose summit is covered with ruins, lies about five leagues to the west of the town of Tehuantepec.

Near the summit of one of the limestone spurs of this mountain is a cave, sloping downward, with several large rooms and passages from one to the other. After a hard climb to the summit a large valley about two miles long is reached. In this valley, surrounded by a massive crumbling wall about 12 feet wide, is a large oblong structure, supposedly a temple, built of small flat stones and lime. It is 33 feet high, 90 by 105

feet at the base, and at the top 75 feet by 60 feet. Four terraces, built one above the other at a distance of six and a half feet, surround the structure. Narrow flights of steps run up to the top at each end and one wide flight in the center. This temple is believed to have been built for offering up sacrifices.

Across the valley, and directly opposite, is another and similar temple, but larger, and with houses built on top. To the south of this is another large mass of ruins, surrounded by a high wall and the ground paved with stones. The natives are full of superstitions concerning these mountains, but tradition has it that the inhabitants of Guihengola were driven away 300 years ago.

Many other remnants of an older civilization can be observed on the isthmus, where today the blending of ancient customs and semi-civilized natives with twentieth-century progress and hustle is very curious to observe.

HEWERS OF STONE

By Jeremiah Zimmerman, D.D., LL.D.

THE ruins of Mitla are the most beautiful, the most interesting, and best preserved ruins in the Republic of Mexico, although they are not the most extensive. Years before the conveniences of modern travel, explorers were attracted to them, so that the world has become somewhat familiar with these unique and remarkable structures. It is partly due to their marked distinctive character, their isolation in the solitude of the remote end of the valley, bounded by the mountains, and owing to the utter lack of information as to their origin, so far as their builders are concerned, and the time of their construction that travelers have been tempted to indulge in extravagant language when referring to the Mitlan ruins.

The extensive mural decorations of mosaic fretwork is almost as perfect as when finished, many centuries ago; but there is no written language there, no inscriptions that shed light on these unknown problems, for all is as mute as the Sphinx of Egypt, and even the records that the ancient race transmitted to their posterity, and which would be of incalculable value to us, were utterly destroyed, with few exceptions, by their conquerors as being the works of the devil who unfortunately has been made responsible for too many human, and also inhuman, shortcomings, as well as the scapegoat for some of the worst crimes of history.

In this article I shall endeavor to give a description of these wonderful ruins, based upon personal observation and the information gained from that able and painstaking explorer, William H. Holmes.

Most of the difficulties that once prevented the ordinary traveler from visiting Mitla have been overcome by the extraordinary progress in transportation, for now we can ride in a rather comfortable train, and even in a parlor car, to within 30 miles of the ruins, and the chief engineer of the Southern Railroad informed me that a branch road had been contemplated and would soon be constructed as far as Mitla. The railroad traverses a section of country that has many attractions, descending from the altitude of more than 7,000 feet at Puebla until it reaches a point where the bed of the road is only 1,768 feet above sea-level, where for several hours we run through the great canyon.

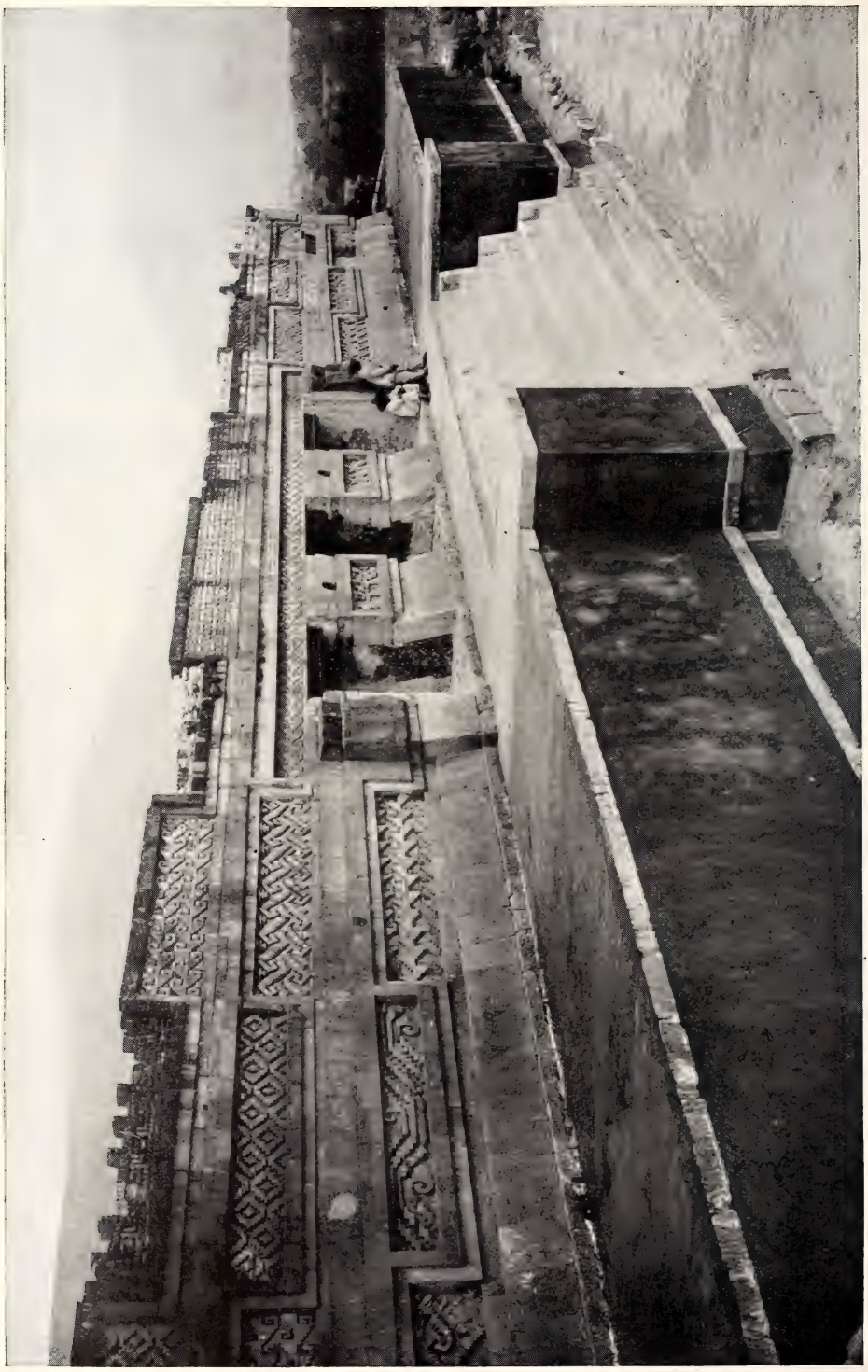
A GORGEOUS LANDSCAPE

There are features in the picturesque scenery above the road that make a lasting impression, and as memory takes us back I see again the mountains standing out in imposing grandeur, the rocky

Photo from Mrs H. Olsson-Seffer

TYPICAL ZAPOTECA WOMAN WITH THE PECULIAR HEAD-DRESS

Note the pendant on the necklace (see page 998)



MAIN ENTRANCE TO THE PALACE OF MOSAICS, MITLA (SEE PAGE 1015)

cliffs and sides streaked with the effective colors and tints that finally shaded and melted away with the native gray stone—a gorgeous landscape that nature had wrought without paint or brush, but produced by the imbedded minerals or native pigments that through the ages have slowly exuded from these castellated mountain palisades, and which remain unfading through the centuries, though exposed to the elements, not on perishable canvas, but on the everlasting mountain slope, the wonder of every beholder. Long after distance made them fade from view we realized that the mental impression was not gone, and in the gallery or chamber of imagery I often seem to behold again that enchanting masterpiece of nature's painting.

As we continued some hours southward we experienced a great change in the temperature, for we had descended rapidly from the high tableland and were passing through the canyon, and the narrow course was bounded by the lofty rocky barriers that excluded the air and seemed to attract and hold the heat. We all perspired freely, with the thermometer climbing to 115° Fahrenheit in the shade, and yet I have suffered far more from the heat at times in Syracuse with the thermometer confined to the eighties, for there is no humidity in Mexico, but the air is dry, and a physician told me that sunstrokes were unknown in that country.

OAXACA HAS MANY ATTRACTIONS

The rapid and diversified change of scenery, amid tropical plants, with that royally grand species of cactus known as the "organo," afforded constant diversion for the somewhat uncomfortable traveler. As we ascended again from the lowland to the plateau the temperature greatly improved, and before reaching Oaxaca we had reached an altitude of much more than 5,000 feet above sea-level and amid magnificent scenery. Again the road descends by gradual curves and soon we reach the city at the terminus of the line.

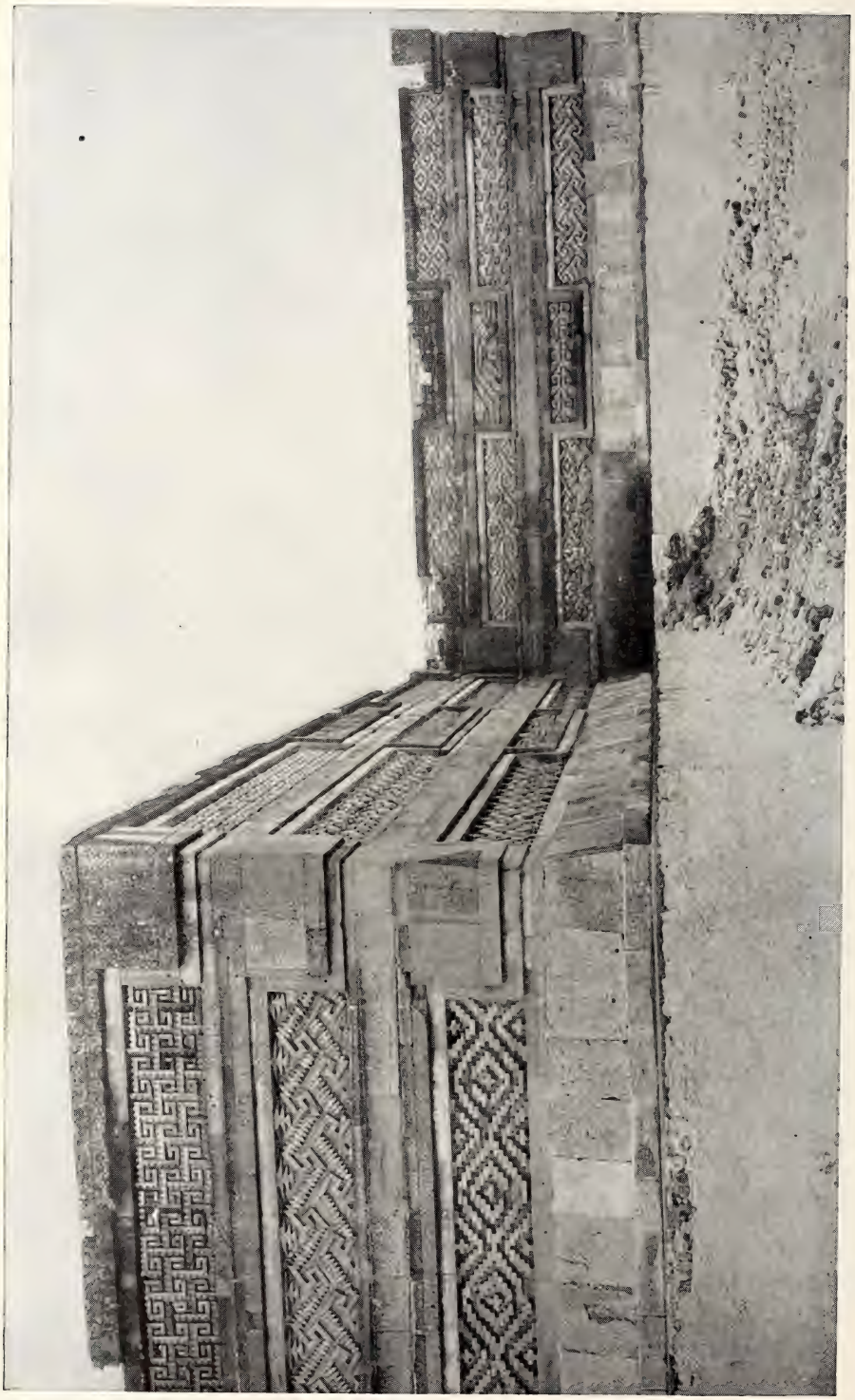
It is fortunate that the cities of Mexico are provided with street cars, for the cobblestone-paved streets are so rough that riding in a carriage, whilst it may be aristocratic, is anything but comfortable, and the poorest peon who occupies the cheapest seat in the very plain and unupholstered horse car suffers far less from the rough streets than the richest man who is jolted over the cobblestones when riding in style in his costly livery.

Oaxaca is a city of great interest and has many attractions that cannot be seen elsewhere. There are some famous churches, with unique and gorgeous decorations, and their resplendent designs of certain ecclesiastical wonders are a fascinating source of reflection for the student, who naturally seeks for a psychological reason for all this strange objective realism.

We found much in these leading churches that were worthy of repeated visits, but there are many other charming objects to be seen in this most interesting city, and the Museum, with its priceless treasures of antiquities from the aboriginal races of Mexico, I found to be of absorbing interest, for it was after all the most interesting and attractive place for me in all Oaxaca, and it is the center of attraction to every student of archeology and anthropology.

These remote people have long since passed away, but here at least is a tangible and visible connecting link, and we can study them in the light of their monumental remains. In many respects there are sermons in these stones, and as we reflect upon them we can read some of their thoughts and feelings, and even religious faith, as expressed in these rude and now often mysterious productions in clay and stone, but which were once altogether intelligible and which were so full of meaning to their cotemporaries.

In fact, these are their only surviving records, for the old Zapotecs and their Aztec conquerors who once inhabited this valley did not transmit to our generation a written history, with dictionary and grammar; and hence, as the sources of our information are so meager, the



ANOTHER VIEW OF THE PALACE OF MOSAICS AT MITLA, SHOWING THE ELABORATE EXTERIOR DECORATION

cotemporaneous works that have come down to us are all the more prized, even for the remotest suggestions of truth that they may contain concerning an extinct race that long ago had attained to a high degree of civilization, but whose origin and history are involved in so much uncertainty. All may easily repeat the same stereotyped questions that have been asked by the most earnest students of this science; but who can answer them?

It is true that in the market-place we may see some strikingly interesting specimens of the Zapotecan race, for these hardy, plump, bronzed Indian women are the lineal descendants, and, though centuries intervene, in many respects they are no improvement upon their remote ancestors, but have even retrograded, so far as personal ambition, enterprise, and achievement are concerned. Of course they have risen in the scale of civilization and are free from all barbaric practices, and are averse to warlike customs and would recoil with utter abhorrence from the shocking cannibalism involved in the worship of their forefathers. Perhaps even their physical resemblances are rather superficial and less marked than their contrasts, for the changed conditions and inevitable admixture of different races would cause a variation in the type.

THE DRIVE TO MITLA

We left Oaxaca at an early hour in the morning that we started for Mitla, in order to escape the rough carriage ride over the cobblestone streets. We took the trolley for several miles, as far as Tulé, famous for the big tree, the largest of which I have any knowledge, with sufficient diameter for several stage coaches to drive through abreast if the center of the tree were hewn out, and there would still be wood enough on either side to support this mammoth giant of the flora kingdom.

It is a long drive, about 30 miles; but I had an excellent carriage, drawn by five horses well matched, and a much-traveled Englishman from Manchester, and with this interesting companion the way never seemed monotonous nor uncomfortable. In this I was agreeably surprised, for it had been described as beyond the endurance of the ordinary traveler, and many were deterred from undertaking the journey owing to these unfavorable reports.

I have often thought it would be a great relief to the traveling public if some of the chronic grumblers remained at home, or else were muzzled, for they do so much to disturb the peace of mind and to afflict the souls of others by telling of all the known evils that exist in the various cities you visit. In no part of the world during some years of travel did I meet such pronounced members of this class as when traveling through the Republic of Mexico. They never made the way natural and easy, but exceedingly difficult and dangerous by their tales of woe, and in every city they would tell you of the insanitary condition of the open sewers, of the smallpox that was raging, and how unsafe it was to take a street car or enter any church, store, or public place, and that severe colds and pneumonia were very prevalent, and that the latter was generally fatal for Americans, owing to the excessive altitude of nearly all the cities on the high tableland. I can imagine the terrible strain upon nervous people; and yet there is no escape from this thoughtless class, who, either from habit or limited interests, force this unsolicited information upon you. They would endure similar inconveniences of travel at home as a matter of course and without a word of complaint. They will race and endure clouds of dust when touring in the motor car at home, and all for pleasure, and call it fun; but to pass through a little dust in southern Mexico to see some of the interesting ruins of the world is too much for their endurance. In fact, they lack the enthusiasm of the genuine traveler and intelligent observer, and especially of the real student of mankind in the past, for some dust is inseparable from all archeological research, and the great explorers who

THE MONOLITHS IN THE HALL OF SIX COLUMNS, MITLA

These monoliths, like every stone in the buildings at Mitla, were cut out of the quarries and shaped by stone implements. The columns were used to support the roof to the court, the ceilings being made of beams of wood or slabs of stone. The roofs were filled with brush capped with rammed clay, similar to the method employed by the Pueblo Indians.

unearthed and brought to light the most interesting antiquities now treasured in the great museums of the world, and the many wonderful remains of the aboriginal races in this valley, and which now attract every visitor to the city of Mexico—these explorers went through, not merely days, but centuries of dust.

The drive itself is not uninteresting, for the long valley has some picturesque scenery, and at the primitive town of Tlacolula the journey was broken for a brief rest and light refreshments, and which prepared us for the remaining eight miles, which were soon covered. Here we reached the end of this beautiful valley, and about a mile from the base of the mountains that here rise on three sides, forming an amphitheater, is the site of ancient Mitla. According to Dr Seler it was the burial city of the Zapotec kings and priests, for it was the custom of these people, as well as of some of the kindred tribes, to bury their dead chiefs in caves, and the extensive caves in the mountains about may have led them to the choice of this site.

THE MARVELOUS RUINS AT MITLA

The insignificant and squalid village that we find here is in striking contrast with the civilization that reared these remarkable structures, although the inhabitants are said to be the descendants of the ancient Zapotecans.

Just why this location was chosen may be seen in its surroundings, the character of its mountain fastnesses, and its remoteness from other nations, and especially because of its water supply, the caves, and the abundant source of the choicest or most easily worked building materials.

Let us look upon these extensive ruins and study their architectural beauty, and then endeavor to transport ourselves into the distant past so as to become contemporary eye-witnesses of the workmen in the construction of these buildings. We must remember, when speaking of these ruins at Mitla, that they were built long after the stone in Europe had been superseded by the use of iron, for the Stone Age in Europe was probably several thousand years earlier than in Mexico. It would be a mistake, and we would fail in our full appreciation of these Mitlan ruins if in mind we were to transport these structures from the valley of Oaxaca to the valley of the Nile, or to Greece and Sicily, or to the colossal ruins of Rome and Baalbek, and then make the comparison with the great architectural achievements of the ancient Egyptians, Greeks, and Romans. Neither should we speak without reserve and qualification, as some are wont to do when indulging in most extravagant language, to express their admiration and wonder at what these races accomplished in Mexico, for these builders had their limitations. They would have builded far better had they been conversant with the architecture of Europe, and they would have made use of the arch and employed very different tools, but they used the knowledge and mechanical arts that they had, and when we keep this in mind we will be amazed at the wonderful works that they accomplished.

In fact, as we picture that age and the actual conditions of their civilization, it is difficult for us to understand how they built so well and reared structures that are still the admiration of the world. Whilst there are no contemporaneous records of the unknown builders to describe the character of their work and buildings, and how they cut the stones from the mountains and fashioned them in shape, fortunately modern explorers have discovered two quarries in the mountain, the one about three and the other six miles distant, where the ancient stone-cutters in great numbers once stood at their tedious and laborious work. There on the mountain range, without dynamite or any of our improved mechanical devices for tunneling or leveling the mountains, or cutting in form and polishing enormous blocks of granite, the swarthy Indian labored with the most primitive tools of the Stone Age, without steel chisel, hammers, and crowbars to overcome the resistance of

AN AUDIENCE-ROOM OPENING ON THE HALL OF THE SIX COLUMNS, SHOWN ON PAGE 1008

The builders did not use doors, but provided sockets beside the doorways for awnings. They were evidently not acquainted with the use of the arch, all doors in the buildings being surmounted by heavy blocks of stone, which weigh sometimes as much as 15 tons.

the softer material. No, he held in his hand a stone hammer, axe, or chisel, though harder than the particular rock from which he obtained his building material.

THE QUARRIES AT MITLA

We are enabled to reproduce the scene as we look upon the thousands of broken fragments and the many worn-out, broken, and rejected tools that still cover the native rocky floor of their once busy workshop, when hundreds of stone-cutters, speaking a strange language and urged on to diligent work by their masters, struck hard blows with rude hammers and axes before the native rock yielded and conformed to the necessary size and shape assigned for it in the building. The place recalls the quarry in the Lebanon Mountains, whence the colossal stones were taken for the temples at Baalbek. Of course, the Baalbek stones were greater in magnitude and the buildings were greater in height and of vaster proportions than those at Mitla, for in a wall 40 feet above the ground are three stones about 65 feet each in length and 15 feet in every other direction, whilst out in the quarry, one-half mile or more away from the temples of Baalbek, we saw a fourth stone of the same size, and almost detached from the mountain with the exception of the lower angle. These enormous hewn stones were much larger than the largest ones used in the wall around Jerusalem or in the great pyramid of Egypt. But these were different workmen who went into the Lebanon Mountains, and they had very different tools, that made the hardest granite and porphyry yield to their stroke.

While the workmen in the quarries near Mitla were restricted to stone implements, they were highly favored in the quality of the rock from which they quarried, for it was not hard granite, which would have rendered such achievements impossible, but a comparatively soft and easily cut stone of volcanic formation, and known as trachyte, but of sufficient hardness for building purposes. To have rock that was easy of cleavage and to cut into shape was of tremendous advantage to these Stone Age builders with their primitive tools, and no doubt they discovered the material before deciding upon the site of their capital. One thing is certain, however comparatively soft the native rock may have been, it has proved to be of superior quality for building purposes, for it is most durable, and even the many thousands of thin pieces that were split off have endured throughout the many centuries, and apparently have in no way suffered from the wear of time and the elements.

I would not leave the impression that the trachyte was of the same character as that singularly soft deposit found in certain places and which exists in great quantities near Palermo, and where huge blocks are cut out of the earth according to the required size for the building. A great area had been excavated, for many of the large buildings in the city had been constructed of the soft material taken from this place. It makes very cheap building material, for no time is required to hew and dress the stone, which is cut from the native bed at once into the size wanted, just as you would cut a slice of cheese, although it is much softer, more like clay. To make the test for myself, with one stroke I easily sank the axe six inches or up to the handle. Yet the stone becomes very hard when exposed to the air and is most durable, for there are no signs of crumbling or scaling off from the buildings after the centuries of wear. Such a deposit is a gold mine for architects today, and the early Mitlans would have been most fortunate had they discovered such material in their valley.

But they had a very different problem to solve, for their material had to be cut from the mountain, and this required an enormous expenditure of time and energy, for the substance was volcanic rock, and after detaching huge blocks there were great difficulties involved in getting them down to the valley, for the quarry was 1,000 feet above the plain,

and then they had to draw them some miles farther to their place in the building. It would not be a difficult feat of mechanical engineering today, with our improved conditions, but we must consider the real difficulties as they actually existed among that primitive people. On the other hand, they had an abundance of time, and labor was cheap, and in a despotic age all the workmen necessary could be pressed into service.

SOME OF THE BLOCKS WERE ENORMOUS

Enough remains in the quarries to enable us to understand their methods. In blocks still *in situ* we may see the process of leveling the upper surface of a huge portion of rock, and then cutting channels on the four sides to form a parallelogram, and next followed the under cuttings from each end, for there are blocks just as the stone-cutters left them after having under-cut away two-thirds of the block. Likely they meant to detach it by means of driving wooden wedges under the separated ends and then soaking them with water, and, possibly, hastening the process by means of a heavy lever.

We can scarcely imagine the amount of labor necessary to cut the stones for the Mitlan buildings, with nothing but rude stone tools, especially as many of these stones were tons in weight. It was a most laborious task, for the workmen had often to take many uncomfortable attitudes, and there were cramped backs and wearied arms and bruised hands.

Some of the stones were of enormous size, such as the lintels, some being 20 feet in length and 4½ feet in each of the other dimensions and weighing as many as 15 tons, while the monolith columns were nearly 15 feet in length and weighed as much as eight tons. There were two heavy jambs required for each doorway, besides the sill or bottom stone, and what consummate patience and perseverance were required to provide all this building material, notwithstanding the peculiarly tractable character of the volcanic trachyte. Some 50 lintel stones remain, varying in length from 10 to 20 feet, but the original number was much greater.

THEY HAD STONE IMPLEMENTS ONLY

Holmes estimates that there were as many as 1,500 wooden beams in all the different groups of buildings as originally constructed. What infinite patience was required for these hewers of wood with stone axes. Without steel or iron, they cut the trees in the forest as best they could, and then cut them again into the required length for beams to support the flat roof.

With all our mechanical skill today, it would be child's play for our architects to rear such one-story structures as those at Mitla, for our age builds skyscrapers and tunnels and runs passenger trains through the mountains and to the summit of the Alps and under great rivers; mounts up on high and soars through space, and dispatches messages through the air to friends far away at sea, achieving wonders that the builders of Mitla never dreamed of; and we must not speak of their architectural triumphs as rivaling ours; for while it was remarkable for them in the Stone Age, and hence of great interest to us, there would be no difficulty in our duplicating it, and even greatly improving it. Therefore, we must not look at it merely in comparison with the greatest architectural achievements of ancient and modern times, but from their own standpoint, in the light of their civilization and knowledge of the mechanical arts and the character of the tools they had to work with. When we consider the conditions under which they labored, we are amazed at what they accomplished, and their triumph in architecture in the face of seeming insurmountable difficulties.

How did they cut down the trees and hew them into shape with their rude tools? Had they lived in the Iron Age and possessed steel axes, saws, planes, and chisels, our wonder would not be so great; but they lived in the Stone Age, and yet with all the serious limitations

FRETWORK MOSAIC AT MITLA, IN THE PALACE OF MOSAICS

The stone slabs or tiles are about one inch thick. It is estimated that more than one million of these stones were used in decorating the buildings at Mitla. When we realize that each stone was cut out of the quarry, not with steel or iron implements, but by stone hatchets and stone tools, the infinite labor and pains required for this form of decoration can be appreciated.

ONE OF THE LARGER TEMPLES OR PALACES AT MITLA

All the buildings in this wonderful group, excepting that containing the Hall of Six Columns, shown on pages 1004, 1006, and 1008, contain only a single long and narrow room with thick walls but one story in height. The stone blocks, though weighing sometimes as much as 15 tons, were cut out of the quarry with their hatchets of stone with such precision that very little mortar was required for the joints.

they produced a most wonderful group of buildings.

The great Hall of Six Columns is 125 feet long by 23 feet wide. These columns are about 11 feet above the floor and probably several feet beneath, and measure 3 feet in diameter at the base, tapering slightly toward the top. They are monoliths with a smooth surface and weigh from six to eight tons each. As the width of the hall was too great for the span of the flat roof, these columns were placed in the center to support the wooden beams upon which they laid the ceiling and roof, and hence this structure was very low as compared with modern public buildings. The row of columns was not intended for architectural beauty, but for a necessary support wherever the width of the room exceeded 12 feet. Some of the ceilings were formed of stone slabs, but when the width or span exceeded 6 feet, then wooden beams were employed.

THE MOSAIC FRETWORK

Every visitor to these celebrated ruins is impressed with at least one feature of originality, whereby those architects produced a wonder-effect in mural decoration by means of the mosaic fretwork. As we look upon this unique feature we may well ask whence came the suggestion or knowledge that led to this particular style of decorative work that we see on the interior walls of the rooms in the buildings at Mitla. Other buildings with similar mosaic fretwork have been discovered in several places in the country of the Zapotecs erected by the same native people; but whence did they derive their knowledge, or was it an original product or development?

Among all the architectural remains that I have seen in any country of the ancients, there is nothing that bears any resemblance to the distinctive character of this decorative work and which could have suggested it.

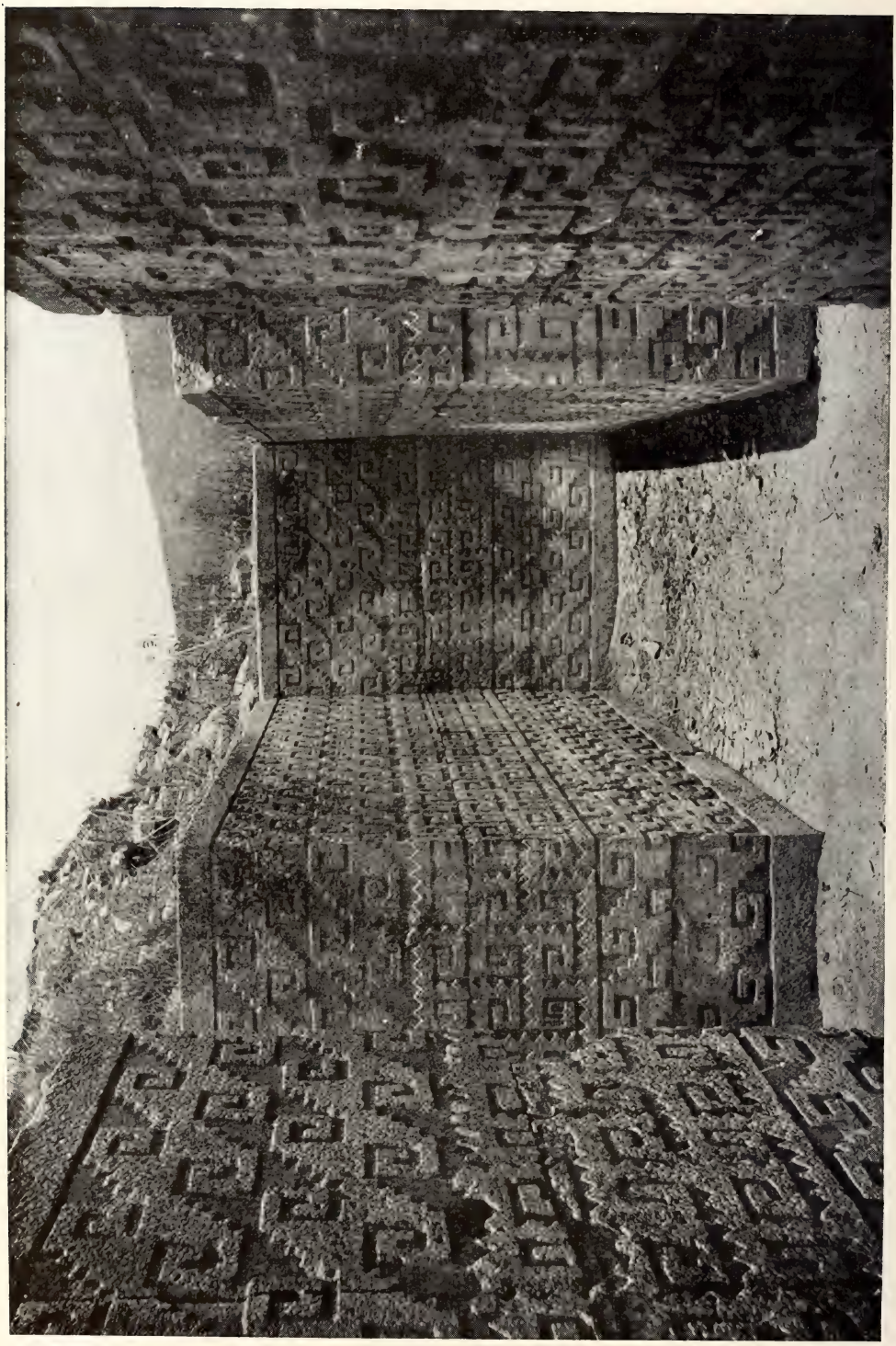
The stones composing the mosaic designs are not the small bits such as characterize the pieces that were employed in Europe, but they are rather stone tiles cut in different size and form for their particular place in the decoration, and generally from one to one and a half inches in thickness and resembling the thin bricks used in the buildings of ancient Rome.

The great quadrangle or court of grecques is 30 feet square and the walls are about 13 feet high. In addition to the doorway by which we enter as we come from the passage leading from the Hall of Six Columns, there are four other doors opening from each side wall into the four narrow halls that are parallel to the sides of the quadrangle, but of unequal sizes. It is uncertain what use was made of these narrow chambers, but they may have answered for sleeping apartments, for in those days sleeping quarters were limited in size and not the large, comfortable rooms of modern times, and where some spend most of their lives. The buildings at Mitla have no windows, the only light and air for the chambers coming from the large inner hall or quadrangle.

While the four halls that surround the quadrangle are so narrow, not more than seven feet in width, the massive walls between them and the inner court are six and one-half feet in thickness.

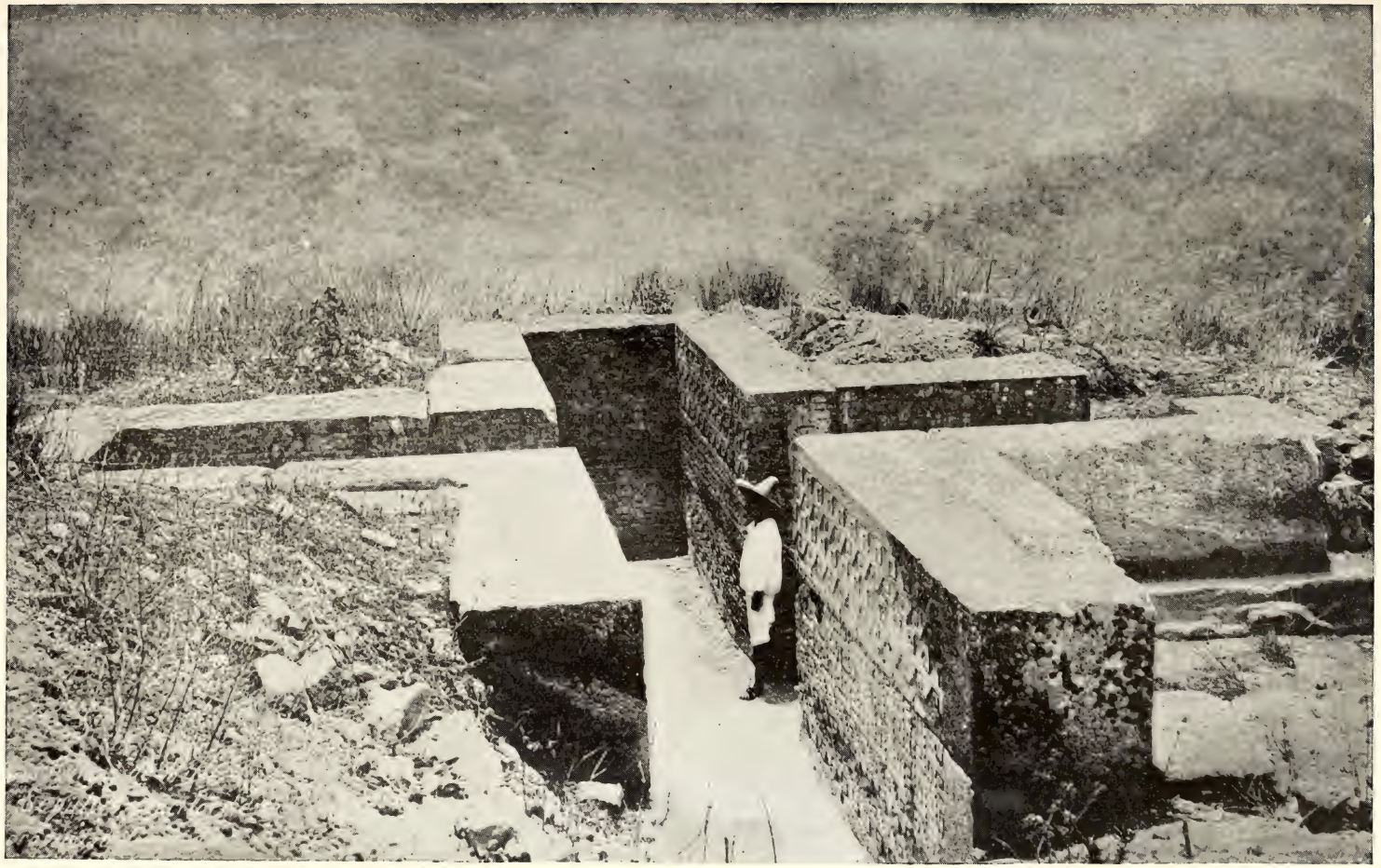
There seems to be no reason for having such a thick inner wall, for it was not for defense, and, in addition to occupying valuable space, it required many months of extra labor to cut and transport the extra stone required. The builders have given us no explanation and we are left to the uncertainty of conjecture.

Of course, in view of their lack of knowledge respecting the use of the arch, it was impossible for them to extend the mosaic decorative work over the doorway, for they were obliged to place the large lintel there instead, some of these weighing as many as 15 tons; but they were equal to the emergency, and, in order to preserve the uniform harmony of the geometric design in the mural ornamentation, they sculptured the stone lintel with the very same grecque design as the mosaic fretwork, so as to har-



THE CRUCIFORM CELLAR AT MITLA

The builders were very skillful in carving intricate designs on stone blocks, notwithstanding that their only tools were made of stone



CRUCIFORM GRAVE NEAR MITLA

Photo from Mrs Harriet Chalmers Adams

Several of these cruciform cellars have been discovered at or in the vicinity of Mitla. They probably were the sepulchres of important priests or nobles. On a hill about a mile from Mitla there are some fortifications, probably built by the same people, which in massiveness and skill compare with the ancient fortifications of Peru. Piles of rounded stones remaining on the walls show that slingers were a formidable means of defense in those days.

Photo from Russell Hastings Millward

THE TORTURE OF GUATEMOTZIN, THE LAST AZTEC EMPEROR OF MEXICO, BY CORTÉS

When his companion complains that he is being tortured beyond endurance by the fire, Guatemotzin replies, "Am I on a bed of roses?"

monize with the other portions of the walls.

EXQUISITE CARVINGS

What impressed me as most remarkable was the skill with which they carved the design into the heavy stone lintels. There was an exactness and finish in details such as we would expect from stone masons with iron hammers and chisels of steel instead of the primitive stone tools. As I reflected upon this fact the question forced itself upon me, Why did they not build or face the walls entirely of large dressed stones and then carve the entire surface with the same grecque design, and which in part they were compelled to do in the treatment of the lintel? It is true the effect would not have been as pronounced as the bold relief appearance which was obtained by the countless pieces that made up the mosaic fretwork. It might have involved even greater labor to have cut and transported the large blocks of stone from the mountain and carved out the design by means of stone tools, for they had to sculpture as many as 50 lintels, and they had no doubt learned from experience the wisdom of building just as they did.

To appreciate the prodigious labor involved, one need but estimate the number of thin brick-shaped stones employed in the mosaic work of the quadrangle of grecques alone, for they exceed 50,000. The various buildings grouped about it would have contained as many as 130,000, and it has been estimated that probably one million of these were used in the mural ornamentation of all the buildings at Mitla. The patience of the workmen must often have been tried when the almost finished bit was broken by a blow of the pick.

Father Burgoa, who saw these buildings at the time of the Spanish conquest, and when they were in far better preservation than today, has left us an interesting and valuable description, although not strictly accurate in every particular. He says, among other things, that "the palace of the living and the dead was built for the use of this one (high priest of the Zapotecs). They built this magnificent house or pantheon in the shape of a rectangle, with portions rising above the earth and portions built down into the earth." Referring to the stone columns, he states that they "are wonderfully regular and smooth. These served to support the roof, which consists of stone slabs instead of beams. But in the construction of the walls the greatest architects of the earth have been surpassed."

The Zapotecans also displayed wonderful skill in the art of painting, and, while unfortunately nearly all of it has been destroyed, yet in the examples that remain we recognize a mastery in painting that is as great a surprise as their mosaic fretwork. It is remarkable how perfect the colors remain to this day, after having been exposed to the elements for many centuries, the surface being still as smooth as polished marble. Although the figures are grotesque, according to their conception of the story which they intended to illustrate, nevertheless the surpassing coloring, the finished detail, and the general artistic effect show the presence of a master of the art.

There arises another question: Why did they not leave some sculptured figures? With such a mastery in the art of painting, and with the evidence of their skill in carrying out the grecque designs in the stone lintels, there can be no reasonable doubt as to their ability to sculpture statues of their heroes and gods; but for some reason they do not seem to have added this art to the ornamentations of their wonderful buildings at Mitla.

FOWL-SELLERS IN MEXICO

Note the turkeys, which are the indigenous variety found in Mexico

Photo from Russell Hastings Millward

AGRICULTURAL POSSIBILITIES IN TROPICAL MEXICO

By Dr. Pehr Olsson-Seffer

Late Commissioner of Tropical Agriculture to the Mexican Government

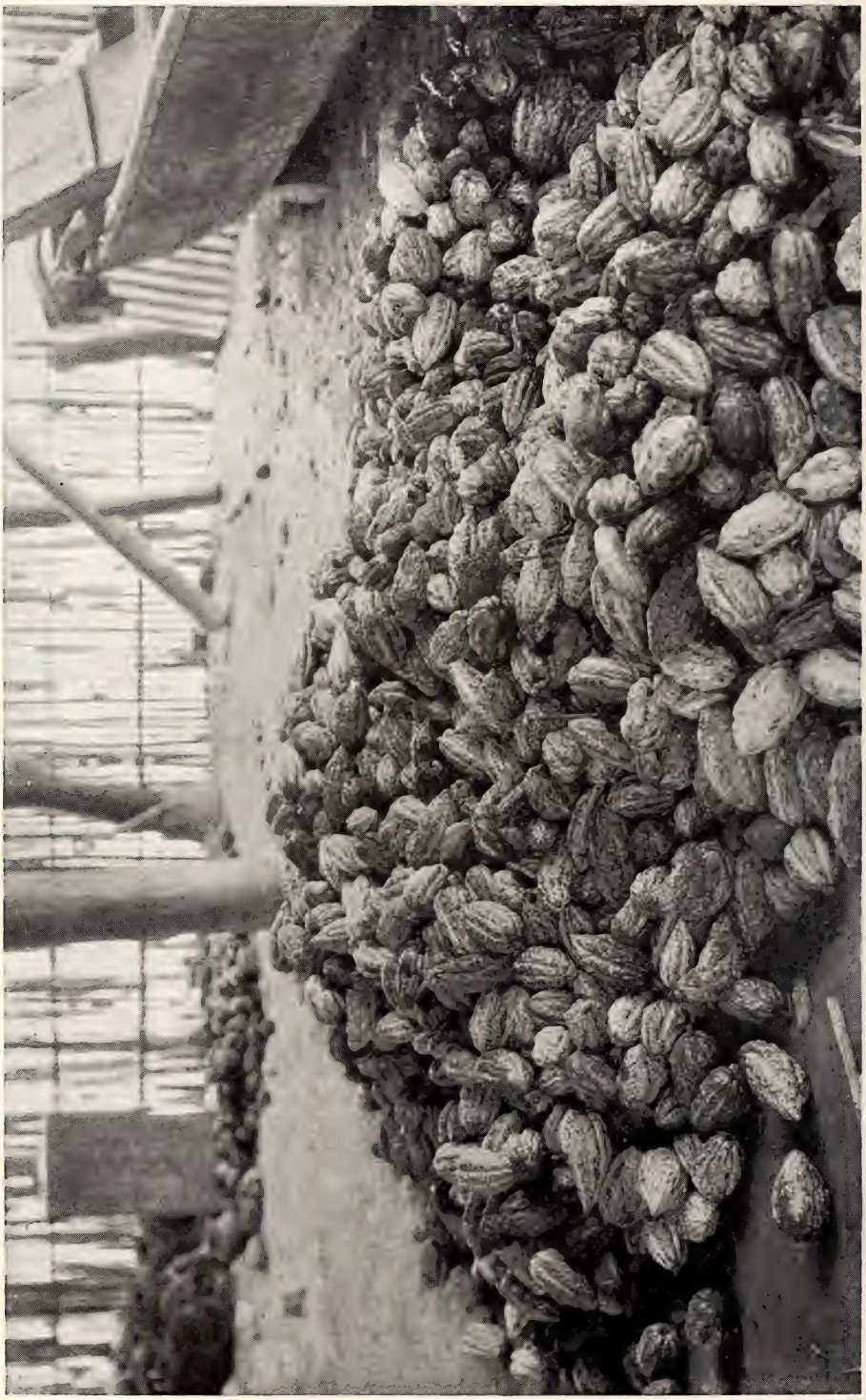
FEW countries offer better natural advantages for successful agricultural operations than the Republic of Mexico. It is true that the highlands are depending on artificial irrigation to produce abundant crops, but in the tropics of Mexico there is water enough. The rainfall varies from 80 to 175 inches, well distributed for agricultural purposes.

On the highlands the forests have been destroyed in times gone by, and devastating floods often occur; but in the "hot country," with immense primeval forests still standing, such floods are mitigated and the precipitation is absorbed by the soil to the benefit of the vegetation.

The native Indian method of corn culture in tropical Mexico does not greatly differ from agricultural practice in many other countries. The "chena" cultivation of the inhabitants of East India, the "svedjebruk" method of the early Scandinavians, the "kaski" in Finland, the "sartage" of France, and the burning off of a hillside for a "milpa," or patch of corn, in tropical Mexico are essentially similar. They are equally de-

Photo by T. F. Lee

INSPECTING CHICLE, THE BASIS OF CHEWING GUM, IN YUCATAN, MEXICO



CACAO, OR CHOCOLATE PODS, READY FOR SHELLING: TABASCO, MEXICO

Photo by Waite

Photo from Russell Hastings Millward

CACAO, OR CHOCOLATE, GROWING IN TABASCO, MEXICO

NATIVE BRICK MANUFACTURERS

The construction in this part of Mexico is, almost without exception, of brick

structive to the forest, equally ruinous to the soil. The attention of the Mexican government has been drawn to this wasteful system, which leads to the impoverishing of the people and the destruction of much valuable land.

Taken as a whole, the Mexican tropics are unusually fertile. Notwithstanding the primitive methods in vogue, the people are able to live easily. The land is capable of producing everything necessary for life, but only comparatively few products are as yet cultivated.

Detailed examinations of the soil conditions and other natural advantages in many parts of the Mexican tropics have given definite evidence of the possibilities of the country. Where there are now a few native villages, whose inhabitants are eking out a scant living, there should be large plantations and prosperous small yeoman farms. Instead of a population of a few millions in the tropical part of the country at the present time, it could support 40,000,000 people. Where there are now some $250,000,000 invested in tropical industries, $75,000,000 of which is American capital, there is room for four and five times that amount.

The government of Mexico, being fully awake to the importance of the tropical southern country, is showing its interest in the planting of industries. Experiment stations are being inaugurated throughout the land, assistance is given to agricultural societies, and commissions are granted for various purposes to improve different industries. President Diaz' administration is favoring the agricultural industries to a very great extent.

The last decade has seen much American capital entering Mexico to engage in

LOADING BURROS WITH THEIR CARGOES OF BRICK

agricultural pursuits. Unfortunately this interest on the part of the American investor has given the conscienceless promoter an opportunity of which he has not hesitated to take advantage. That this has been to the detriment of legitimate undertakings is certain. However, the public has become wise, and is now better able to discern between honest and dishonest concerns.

Every country needs tropical dependencies. Whether these are political dependencies or not is immaterial to the subject under discussion. Every country situated in a temperate climate needs a large amount of tropical produce. Coffee, tea, cacao, sugar, spices, fruits, fibers, rubber, camphor, vegetable oils, condiments, drugs, tobacco, tropical cereals, such as rice, and various starch-producing plants, as arrowroot and cassava, are imported in great quantities to northern countries. The United States have wisely in recent years acquired some tropical dependencies, to which naturally capital from the home country is diverted. But the Philippines, Cuba, Porto Rico, and Hawaii, even if developed to their full capacity, are not sufficient to supply the United States with the colonial produce needed.

American capital has therefore become interested in the production of many other countries, and principally so in those close at her door—Mexico and Central America. As tropical agriculture has proved a profitable undertaking, it is only natural that capital should turn towards these countries and towards agricultural investments. This desire for investments in the American tropics is becoming more and more evident, and Mexico is now getting her share of this outflow of capital.

THE COFFEE INDUSTRY IN MEXICO

Although the competition with Brazil is keenly felt by coffee planters throughout Mexico and Central America, coffee-growing has not decreased as an industry in Mexico. This fact is ascribed to the superior quality of most of the Mexican coffees, which can find a good market despite the reduction in price of coffees from other countries.

Coffee in Mexico is generally grown at an elevation of 2,000 to 5,000 feet. In certain districts the coffee plantations are

situated below 1,000 feet, but it is a recognized fact that coffee grown at such low elevations is inferior in quality. The only redeeming feature is that the quantity produced is so much greater, which compensates the planter for the lacking flavor and consequent lower price.

Under the present conditions of the world's coffee market, it is not very likely that the area under coffee in Mexico will be greatly increased. One of the most important factors in coffee culture is the supply and price of labor. A coffee planter needs his laborers only during a certain part of the year, and he then requires cheap labor for the picking of his crop. Labor in Mexico is becoming expensive, and it is, moreover, very scarce. By expensive labor on plantations is meant labor that is paid 50 cents per day, which generally is considered too high for crops such as coffee.

CACAO, THE FOOD OF THE GODS

In olden times much more cacao was grown in Mexico than at present. The Aztecs prized cacao very highly, and beans of this tree were used as money until the time of the conquest, when gold became the means of exchange.

Cacao has been grown in Mexico, especially in the State of Tabasco and in the Soconusco district in Chiapas. So well known were the productions of these parts of Mexico that two kinds of cacao became world renowned under the names of tabasco and soconusco. In Chile and Peru cacao is still named soconusco, and it is a mark of honor to be invited to a cup of "soconusco." This Soconusco cacao was sent to the King of Spain among the contributions from the viceroyalty of Mexico. Until some 30 years ago Soconusco cacao retained its name for superiority and regularly occurred in the market. Today a very small quantity only is grown in that district, and the total production is consumed locally.

The reason for the discontinuance of cacao cultivation in Soconusco was mainly the indifference and indolence of the natives. The district was opened up and opportunities for making a living became more varied. The native does not care to bother when he can make sufficient for himself and family by working two or three days of the seven in the week.

In recent years the culture of cacao has been stimulated by the high prices of this product. Several foreign companies and individual planters have begun to devote attention to this crop, which promises to become one of the most profitable products of the soil, although it takes some six or seven years until a full crop is obtained after planting.

TEA-GROWING

This industry has as yet made no headway in Mexico. One or two American companies have gone into this kind of planting, but their example has not been followed. The main reason of this indifference is probably the general prevailing ignorance of the subject of tea-planting.

Experiments and investigations of the conditions for tea-growing in Mexico have shown that an excellent quality of tea can be grown in many districts. The planters in Ceylon, India, and Java, as well as the native farmers of Japan, Formosa, and China, are making a good thing of their tea gardens, and there is no reason why considerable areas in Mexico should not be put under this crop.

The consumption of tea in America is considerable, and with an open and good market at their very doors, Mexican planters should realize their opportunity in this regard.

SUGAR-CANE

The sugar industry in Mexico dates back to prehistoric times. Different sweetmeats have always been in great favor with the natives of the country, and they were made from the home-made "panela" sugar, which is still being manufactured in the tropics of Mexico in the old primitive way, by grinding the cane between upright wooden cylinders drawn by a team of oxen, and boiling the sugar in large open pans.

Very few improvements are applied by

A LUXURIOUS VANILLA VINE: THE LONG FLESHY PODS MAY BE DISTINCTLY SEEN

SORTING BEANS IN MEXICO

Photo from Russell Hastings Millward

the natives themselves, but on the large haciendas, owned by the descendants of the Spanish invaders, modern machinery is in use. Many foreign companies and capitalists have invested in sugar-cane properties, but it may generally be said that the sugar industry is not nearly in the high grade of development which characterizes the sugar plantations of, for instance, Hawaii.

Very little attention has been given to improvements of the varieties of cane grown, and it is not unusual to find large plantations of native cane low and thin and containing only a low percentage of sugar. The same land, if cultivated properly and planted with better varieties of cane, is capable of producing twice the amount of cane and nearly three times as much sugar.

In the milling methods many betterments could be effected. Very few Mexican sugar mills employ a chemist, and with the rule of the thumb system employed much is lost in the manufacturing process.

Certain parts of tropical Mexico have excellent soil for sugar culture. If proper modern methods of cultivation were adopted, fertilizers used, and an intelligent system of irrigation practiced, Mexico could double its sugar production from the area now under cane.

The total production of sugar in Mexico is only little more than the consumption within the country. The communications are good from Mexican ports, and the country could well enter into competition with other cane countries in the world's market. To do so it needs men with knowledge and capital to invest in sugar culture.

OPPORTUNITIES IN SPICE-GROWING

Cultivation of spices has been neglected in Mexico. Among the few that are grown are pimento and ginger, but neither is of any importance in the production of the country. Chillies, however, are grown in quantities, but mainly consumed within the country, being the principle spice used by the Mexicans of all classes.

Jamaica is the only country whence pimento or allspice is exported at present. As it grows on even a very poor soil along the seaboard slopes, there is no reason why its cultivation in moderate quantities, allowing some export, would not be successful in Mexico.

The ginger plant has been distributed to all tropical countries, and is found in many parts of tropical Mexico growing without attention or care. There are many tracts of Mexico where ginger could be grown at a profit.

The nutmeg tree, which furnishes the nutmeg and mace of commerce, has been tried with success in Mexico, but its culture on a commercial scale has not been undertaken in this country. The localities suitable for this industry are, moreover, very limited.

The clove tree has been cultivated for many years in the West Indies, and it grows well in parts of tropical Mexico.

Cinnamon is extensively used in Mexico, as in all Latin countries, but its cultivation has not been undertaken in this country. The Ceylon cinnamon tree has been grown experimentally and succeeds well. In certain coffee districts in southern Mexico cinnamon-growing would doubtless be profitable, at least to the extent of furnishing the home market. Besides its use as a spice, cinnamon produces the cinnamon oil of commerce, for which there is always a limited market.

Cardamons would also be suitable on a small scale, and pepper culture would offer sufficient inducement to a few growers.

A VARIETY OF TROPICAL FRUITS

Mexico produces most of the fruits occurring in the tropics. The quantity grown is so insufficient, however, that very little is exported, and even within the country it is very difficult to get tropical fruits in the town markets. What is sold is very inferior in quality, showing that no care has been bestowed on the raising of the fruit.

Bananas are grown all over tropical Mexico, but systematic cultivation for export purposes has only been begun within

Photo from Chas. Kirby Fox

LOADING SUGAR-CANE: EL DORADO, SINALOA

LABORERS RETURNING FROM THE SUGAR-CANE FIELDS, SINALOA

Photo from Chas. Kirby Fox

DRYING THE HENEQUEN FIBER OF WHICH ROPE IS MADE, MEXICO

the last few years. Good communications and nearness to market are essential requirements for a banana industry. Such conditions, combined with good soil and sufficient water, are to be found in many locations in Mexico. The Tampico district is probably the best, but the coast lands of Tabasco and Vera Cruz, on the Atlantic, and of Chiapas and other coast States on the Pacific, are suitable.

Excellent pineapples are grown in Mexico, and the possibilities in this fruit are great, as it can be shipped fresh as well as canned.

Cashew nuts are grown in the extreme south; jujubes occur in places; the orange berry, or limoncito, the pomegranate, and the guava are no strangers, and the sapote chico, or sapodilla, is one of the most appreciated fruits in the country, as well as one of the commonest. The ground cherries, or "tomates de brihuega," are found in many native gardens; the tuna, or fruit of the prickly pear, is a favorite fruit in Mexico. Mulberries are widely planted, and the mango reaches perfection in certain districts, especially the variety known as the Manila mango. Were this fruit grown in sufficient quantities to be exported to the United States, it would certainly become a favorite in the market. At present not enough is grown to furnish sufficient fruit for home demands.

Of the various citrus fruits, oranges do well, lemons are grown in quantities, and limes, citrons, and grape-fruits are commonly cultivated.

The papaya, or papaw, is another tropical fruit which is easily cultivated and has a ready sale. Mexico has better varieties of this fruit than probably any other tropical country.

The breadfruit tree is grown in the south of Mexico, but very little used for culinary purposes. The various anonas, as the custard apple, the sweet-sop, and the sour-sop, are only sparingly cultivated.

The avocado, or alligator pear, is grown to perfection in Mexico, especially in Tabasco, and would form a valuable article of export if produced in larger quantities.

In regard to fruit-growing generally in the tropics, much could be done by small capitalists, especially if several combined for coöperative export.

MEXICAN FIBERS

Mexico is essentially a country of fibers. The henequen, or sisal hemp, production of Mexico is enormous, and many millions have been made by the henequen planters of Yucatan, which is the chief seat of this industry.

Pita fiber and ixtle are two other fibers well known as specifically Mexican, and the zapupe has recently come to notice. Cadillo fiber occurs wild, and has not yet been grown to any extent. Its high price in the market should, however, warrant its cultivation.

Cotton is grown in northern Mexico, and recently the introduction of the hybrid Caravonica cotton from Australia has revived the interest in cotton-growing in the Mexican tropics, especially on the Pacific slope, which is eminently suited for this purpose.

RUBBER-PLANTING

Few tropical industries have received more attention in late times than rubber. The spreading use of this commodity in connection with electricity and in the bicycle and motor tire industries, has raised the price to a high level, and consequently rubber culture is being studied all over the tropical world.

Mexico has until recently been leading in regard to the area planted in rubber, but the development of the industry in this country has been somewhat retarded on account of the many promotion schemes of imaginary rubber plantations which have been sprung upon the American public.

The large yields which the rubber tree produces are, however, sufficient to induce capital to take up this industry, although the time of waiting for returns on the investment is very long—as much as six and seven years.

The investigations and experiments of the last few years of the methods of cultivating and preparing rubber have placed the industry on a firm footing.

MASKS FOR SALE FOR A FIESTA IN A MEXICAN TOWN

Photo from Russell Hastings Millward

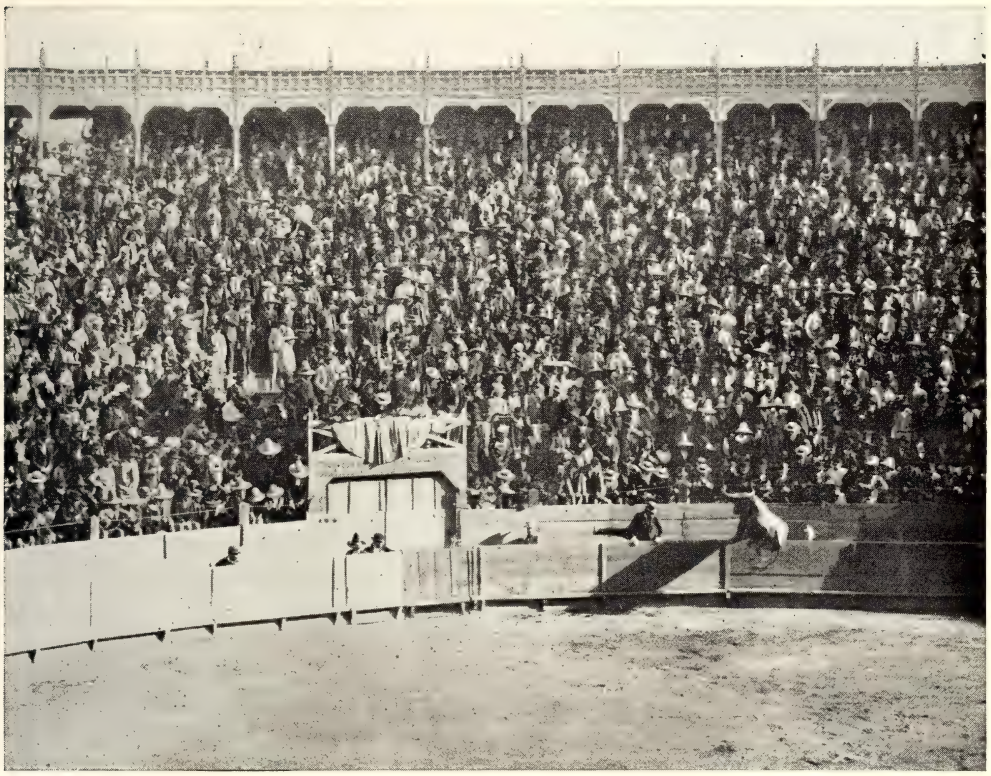


Photo from Mrs Harriet Chalmers Adams

AN ANXIOUS MOMENT: MEXICO

The details of the industry are now quite well known; there is no need of costly experiments, but the rubber planter can develop his estate with as much certainty as a coffee or cacao grower.

Growing of camphor has only been experimented with in Mexico, but many planters have recently become interested and small plantings are being made in various parts of the country, so that in a few years there will be sufficient to crop. Camphor cultivation promises to become a very important industry, as camphor is being used to a great extent for industrial purposes. Mexico has large tracts of mountain lands in the tropics suitable for this industry, and is only waiting for capital and enterprise.

PROTECTION FOR FOREIGN INVESTORS

Law and order are well upheld in Mexico—better than in many countries claiming a higher degree of civilization. The traveler is perfectly safe in any part of Mexico. Where trouble has arisen it has been upon the provocation of the traveler and stranger, who has not taken into consideration the peculiar customs of the country, but has wanted his own way, whether this has been in accordance with the desires of the natives or not.

Foreign investors in agricultural properties are well protected in Mexico, whether the investment is made by private persons or corporations. The latter need not be Mexican corporations, but it is always safer for a foreign company to be legally registered in Mexico. Land titles are not always good, and the purchaser of agricultural land in the Republic should take good care in having the documents properly investigated by reputable lawyers practicing in Mexico.

Photo from Mrs Harriet Chalmers Adams

THE POPULAR DIVERSION AMONG THE UNEDUCATED CLASSES: MEXICO

Photo from Mrs Harriet Chalmers Adams

A CONSIGNMENT OF FIGHTING COCKS

Note the specially constructed basket, with its padded sides. Only specially bred cocks are treated with such consideration

YAQUIS WAITING FOR TRAIN TO YUCATAN, MEXICO Photo from Franklin Adams

Owing to the continual disturbances of the Yaqui Indians the Mexican government transported a large number of them from Sonora to Yucatan

Photos from Mrs Harriet Chalmers Adams

LOADING YAQUIS FOR YUCATAN, MEXICO

A GROUP OF YAQUI INDIANS

STREET SCENE IN ALAMOS, SONORA, A TYPICAL MEXICAN TOWN

Photo from Chas. Kirby Fox

AN INTERESTING VISIT TO THE ANCIENT PYRAMIDS OF SAN JUAN TEOTIHUACAN

By A. C. Galloway

BOARDING the train that leaves Mexico City at 7 a. m., the traveler arrives at San Juan Teotihuacan soon after 8 o'clock. There is also a good automobile road which is often chosen by visitors.

In Egypt he would be greeted with the cry of "Change cars for the Pyramids." Here we were met and escorted to a handcar on a short narrow-gauge road used by the government during its present work, which, propelled by four soldiers, was soon in rapid motion. Once out in the open, we enjoyed the mode of transit while inhaling the fresh, crisp air of a cool January morning. As seen from the train, the pyramids appear almost insignificant, and only by near approach are the ambitious heights to be appreciated.

We passed first through what is known as the Casa de Sacerdotes (house of the priests), showing remarkable walls, terrace, and stairway of 13 steps, all in excellent preservation. Different sections are to be seen open to the light of day after centuries of darkness. Canals cut in the walls show their uses as conductors of water, while portions of decorations and designs on the walls still exhibit most beautiful tones and shades of colors, in the mixing of which time has not given away the secret.

There is also a subterranean dwelling which we went through, and this is almost entirely excavated. As the guide led us from room to room with lighted candles, drawing attention to different things of interest, we wondered what were the secrets that had remained hidden for so many centuries, and why the choosing of a house built underground. The holes in the walls at the entrance show how security was assured, much as in the present day in primitive structures of the Indians. Imagination conjures up many pictures and peoples once again these silent chambers with the moving figures of a by-gone race, but such an impenetrable mist of fable envelopes the early history of Mexico that scientific investigation as well as archeological research have not yet lifted the veil to disclose the secret of these pyramids nor who were the builders, although it is asserted by historians that they were constructed by the Toltecs, while others claim that they were built by the Totonacs, pre-Toltec in history. All refer to them as a great religious center.

It may here be of interest to observe that the Toltecs are traced to have settled in the ancient city of Tula (near the capital of Mexico) about the year 674 of the Christian era. This enables the reader to form an idea of the centuries that have passed since the construction of the pyramids, if conjecture alone can be accepted as history.

Certain it is that the pyramids of Teotihuacan, as well as that of Cholula, have kept their heads above the vomiting of angry volcanoes for numberless centuries, while it would appear that the cities near by were without doubt buried in those bygone ages by volcanic eruptions. The Toltecs were by tradition famous mound-builders, and here it seems they mingled with their reverence for the Supreme Being the mythical religion of astral worship. Their earliest temples were devoted to the sun. The moon they worshiped as his wife and the stars as his sisters. No image was allowed within these temples, and their offerings were perfumed flowers and sweet-scented gums.

Going some distance in an opposite direction, we entered a fine grotto. On the occasion of the visit of President Diaz and party, it was converted into a banqueting hall, and the effect was

THE MOST COLOSSAL STRUCTURE OF PREHISTORIC MAN IN AMERICA: THE PYRAMID OF THE SUN (RESTORED): TEOTIHUACAN, MEXICO

"In the magnitude of its remains and in the evidence the site furnishes of population and antiquity, Teotihuacan stands easily at the head of the ancient cities of Mexico. It lacks the well-preserved, sculpture-decorated buildings found elsewhere in Mexico and Central America, but this is doubtless due to the rarity of suitable building stone in this part of the valley. The famous structures of Mitla, Palenque, Uxmal, and Chichen-Itza, had they been built of such materials as are here available, would today be mere rounded heaps of débris."—W. H. HOLMES.

VIEW OF THE PYRAMID OF THE MOON FROM THE TOP OF THE GREAT PYRAMID OF THE SUN

There are nearly 200 mounds surrounding the pyramids of the Sun and of the Moon, which probably in ancient times were crowned by temples and public buildings

Photo from Mrs Harriet Chalmers Adams

HATS AND BASKETS FOR SALE: MEXICO

grandiose as well as historical. Owls and strange night-birds fly in and out and build their homes behind columns of lava, and these in rude, strange eloquence seemed to express their disapproval of our momentary invasion.

Soon we stood at the foot of the highest pyramid, "El Sol," which has so recently been bereft of the mantle of grass, underbrush, and trees that for centuries had covered it. Looking upward, we realized the infinite labor that has shown to the world of today the arduous task of the ancient Toltecs, and the pyramid, like a sentinel of time, stands as an imposing monument, Sphinx-like in its impenetrable mystery and silence, hiding within its depths those secrets yet to be discovered.

The projecting stones, seen here and there over the pyramid, mark the upward progress of those indefatigable workers until they gained the summit of their ambition. The pyramid was divided into stories by placing a series of truncated pyramids one above the other.

Two hundred and sixty-eight steps must be climbed to reach the summit. The pyramid is 216 feet in height, and has a base about 761 feet square. The summit is 59 by 105 feet square. Now and again on our way upward we found a few minutes' rest desirable, while others of our party remained half way until our return. Some distance up there is a stairway that calls much attention and evidently leads to the very bowels of the pyramid. What secrets may it divulge as the excavation is followed deeper and deeper? Perhaps some hidden sarcophagus of Toltec priests and their people, or a tomb of ancient Toltec kings; but all is conjecture and therein lies the mystery and charm of the pyramids. President Diaz expressed great interest in this stairway on his visit to the ruins some time ago.

Many strange idols have been dug up—Dioses of grotesque form and many others. Many beautiful pieces of jade and obsidian, arrow-heads, little heads of burnt clay, earthen jars of antique form, and others similar to those in use at the present time. One little piece of cloth that was found is carefully guarded in the museum. What was its use? Many skulls, as well as some skeletons, have also been unearthed.

The general theme of the stone tracery yet discovered is the emblem of the sun, its rays being especially noticeable in all carvings and designs—significant of their religion, "the astral worship."

Photo from Mrs Harriet Chalmers Adams

AZTEC CALENDAR STONE IN THE NATIONAL MUSEUM, MEXICO CITY, MEXICO

The ancient Mexican year, like ours, was 365 days, but it was divided into thirteen months. The face in the center of the above picture is the "God-Star" throwing his light over the earth, which is represented by the tongue projecting from his lips.

Having reached the summit, we were richly rewarded, for a fine expanse of country lay unfolded to our gaze, with just a peep of the snow-capped volcano Popocatepetl far in the distance, while yonder the little town of San Juan appeared sleepily dreaming under the shadow of the pyramids. Turning to the right, not far distant stands the Pyramid of the Moon (la Luna), smaller than the one we have just ascended, but looking very green and attractive, covered yet with its mantle of grass, heavy underbrush, and trees, through which is clearly defined the little pathway we shall soon tread, as so many travelers have already done. This pyramid will gradually undergo the process of regeneration, and in the course of months will appear bereft of its covering and stand in clear outline against the azure sky, as does its mate, "El Sol."

Photo from Mrs Harriet Chalmers Adams

STREET IN GUANAJUATO, A TOWN NOT FAR FROM MEXICO CITY

But to many there is a beauty in the soft covering of innumerable centuries, which for the preservation of the monuments must now be swept away. It enhances the ruggedness of man's efforts in his ambition to construct such enduring monuments, and softens, with its gentle touch, every stone and corner. "La Luna" is 150 feet high, while its base is 170 by 142 feet.

Between the two pyramids the eye traverses the street of the dead (el callejon de los muertos) until the "Salon of Agriculture" is reached, where behind

glass cases some remarkable designs and colored archeological treasures are guarded. The ancient Toltecs were artists in the beautiful shades of color they used, which are still visible, especially the pinks and greens. In another direction we observed what is said to have been the "citadel" of this buried city, showing a large mound surrounded by fifteen smaller ones. All of these will eventually be excavated.

In all there exist 180 mounds surrounding the two large pyramids, which are to be treated similarly and their preservation thus assured. Looking over the scene, one harmonizes the purposes of these with the environment. Some of them were forts for defense; some of them were religious, with their court of women, court of laity, and other societies. If only on some bright, sunny day the pageant could return, as we picture it during the Toltec dynasty, what a remarkable sight it would afford! Every terrace filled with strange people, with strange costumes in which gold and silver and the gaudy plumage of tropical birds lent their willing service.

But in the words (which history has preserved to us) of the great King Nexahualcoyatle, King of the Toltecs, whose death took place about the year 1470, we find an answer: "All round, the world is but a sepulchre, and there is nothing that lives on its surface that shall not be hidden and entombed beneath it. The things of yesterday are no more today, and the things of today shall cease perhaps on the morrow. These glories have all passed away, like the fearful smoke that issues from the throat of Popocatepetl, with no other existence than the record on the page of the chronicler. The great, the wise, the valiant, and the beautiful, alas! where are they now? That which has befallen them shall happen to us and to those that come after us. The horrors of the tomb are but the cradle of the sun and the dark shadows of death are brilliant lights for the stars."

The mystic import of this last sentence, says Prescott, seems to point to that superstition respecting the mansions of the sun which forms so beautiful a contrast to the dark features of the Aztec mythology.

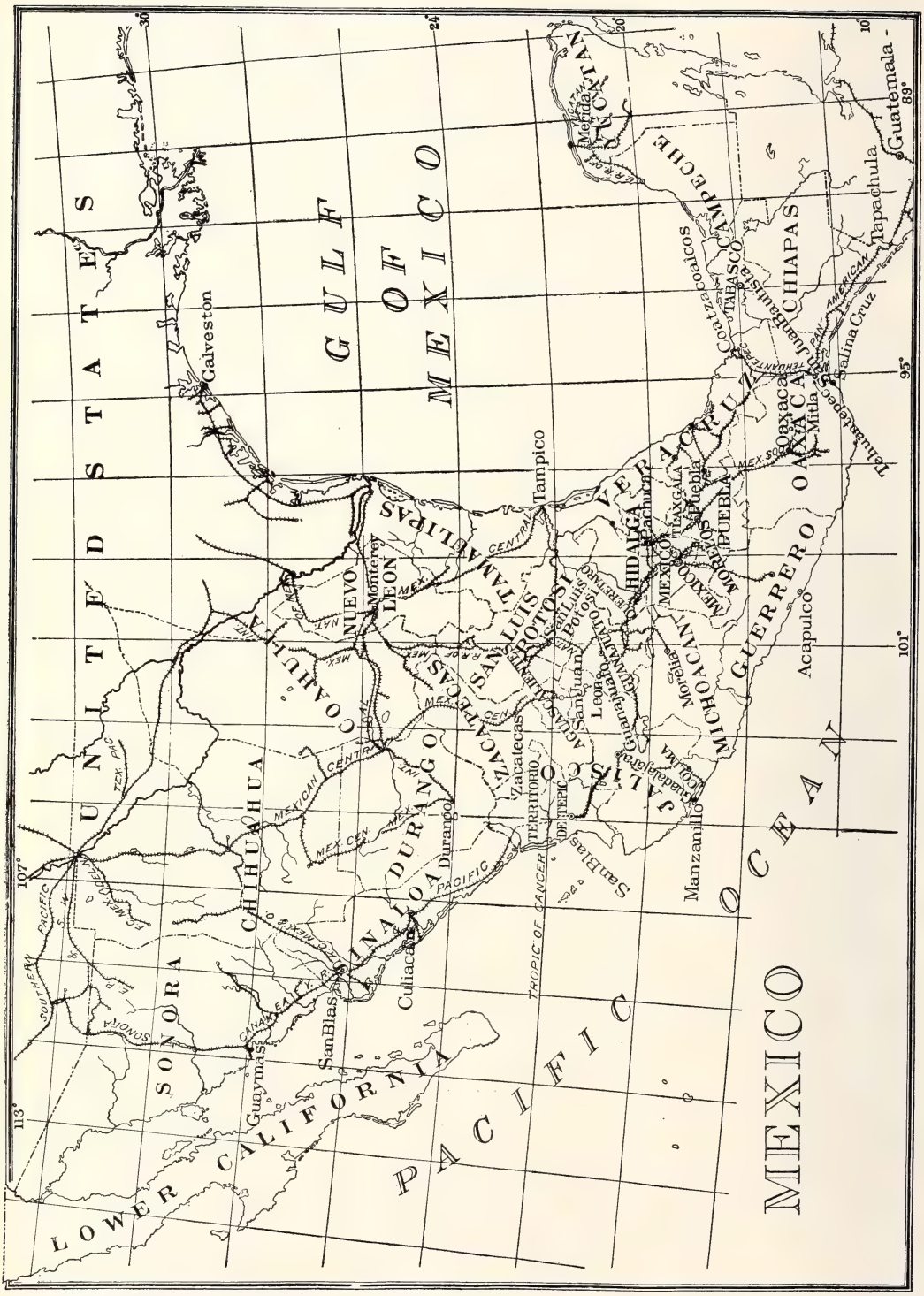
A PROLIFIC COFFEE TREE: MEXICO

VIEW OF A DEEP BARRANCA IN MEXICO Photo from Mrs Harriet Chalmers Adams

This picture shows the interception of these wonderful gorges in the midst of comparatively level plains

SCENE ON THE PACIFIC COAST: SINALOA, MEXICO

Photo from Chas. Kirby Fox



OUTLINE MAP OF MEXICO

A NORTH HOLLAND CHEESE MARKET

By Hugh M. Smith

Deputy Commissioner, U. S. Bureau of Fisheries

ALKMAAR, celebrated in Dutch history for its successful defense against the Spaniards in 1573, has been noted in modern times for its cheese trade, which is the most extensive in North Holland. The town, of 20,000 people, displays the neatness and cleanliness typical of the country, but would have little attraction for foreign sightseers beyond its quaint seventeenth century domestic architecture were it not for the great market in round yellow cheeses with which, in America, the name Edam is associated.

The market is held every Friday, and is participated in by the dairymen of all the surrounding districts, some of whom bring their cheeses in wagons and carts, while others find it more convenient to come in canal-boats. Preparations for the market begin the day before, as considerable time is required for the unloading and arranging of the cheeses, and the afternoon before a market day is an occasion of much bustle. The intervening night interrupts operations on the market space, but bands of young peasants, men and women, parade the streets all night

THE CHEESE MARKET IN FULL SWING Photo by Hugh M. Smith

A part of the golden field as seen from a window in the weigh-house tower. Each of the piles contains from 500 to 900 cheeses

THE WEIGH-HOUSE AT ALKMAAR, 1582

In the canal are barges in which cheeses have been brought to market

long singing and skylarking, and cheese carts continue to arrive in the darkness and clatter along the stony pavements. Therefore there is little sleep for the visitor who has come to Alkmaar the day before to be ready for the great sale.

The market is held in a large rectangular, stone-paved square bounded on one side by a canal and on three sides by tall buildings occupied by shops and restaurants. The weigh-house, formed more than three centuries ago out of an already existing church edifice, dominates the market place. Its shapely clock-tower has moving figures of horsemen in a tourney and a beautiful carillon, one of whose airs is the wedding march from Lohengrin. Fancy buying cheese under such romantic circumstances!

The cheeses, whether in wagons or boats, are not carried in bulk, but are carefully arranged in layers separated by boards to prevent crushing or bruising. When ready for unloading, the wagons are drawn as near as practicable to the spaces assigned to their respective owners, and the canal-boats are moored alongside the quay; then, a piece of canvas having been spread on the stones, the cheeses are unpacked and arranged in square or oblong piles with narrow walks between. Usually the piles are 8 or 10 cheeses wide and 30 to 50 long, but some are only six cheeses square, and the piles are always two layers deep. The largest single pile at the market, here illustrated, contained 900 cheeses.

Photos by Hugh M. Smith

CHEESES BEFORE THE WEIGH-HOUSE

The unloading of the wagons and boats is one of the most interesting features of the market. One man, standing in a wagon or boat, takes two cheeses at

A REMOTE CORNER OF THE MARKET

A pair of official porters are taking a tray-load of cheeses to the weigh-house. The picture shows how carefully the piles are covered until and after the hour of the market

a time, one in each hand, and throws them to a man, either sitting or kneeling on the ground, who arranges them in regular piles. If the distance is considerable, an intermediate catcher and thrower may be required, but a throw of 30 feet presents no difficulties. The cheeses go through the air as though tied together, and are dexterously caught, a fumble being almost unknown. At times, especially during the strenuous half hour preceding the opening of the market, the yellow balls fly thickly in all directions.

Pending the beginning of the sale, the finished piles are covered with canvas, which is often supplemented with rush mats, straw, or grass, to protect the cheeses from sun and rain, and also to prevent drying of the surface; during the night, also, the canvas is thrown over the piles. We would not expect a Dutch tradesman to neglect any precaution that will improve the appearance of his goods; consequently we find that the cheeses are thoroughly greased to make them look fresh and inviting, and immediately before the sale some of the vendors, with a dish of oil and a soft cloth in hand, will liberally anoint every cheese in the upper layers.

Shortly before 10 o'clock the four large balance-scales in the weigh-house are adjusted with the most scrupulous care by a man in silk hat and frock coat, and a large number of aged porters ("Kaasdragers") congregate in an adjacent room and soon emerge clad wholly in white except for their black slippers and bright-colored straw hats. The hats are of blue, red, yellow, green, purple, and other distinctive colors, with ribbons of the same shade hanging down behind, and the men wearing the same colors work together in pairs.

Promptly as the clock in the weigh-house tower sounds the hour of 10, the bustle assumes a new aspect; promiscuous conversation, with a strong caseous bias, ceases and cheese becomes the sole topic; the countrymen remove the coverings from their product, and the whole field bursts into golden bloom, and im-

Photo from Hugh M. Smith

WINDMILL OF WALCHEREN, OF THE PROVINCE OF ZEALAND, HOLLAND

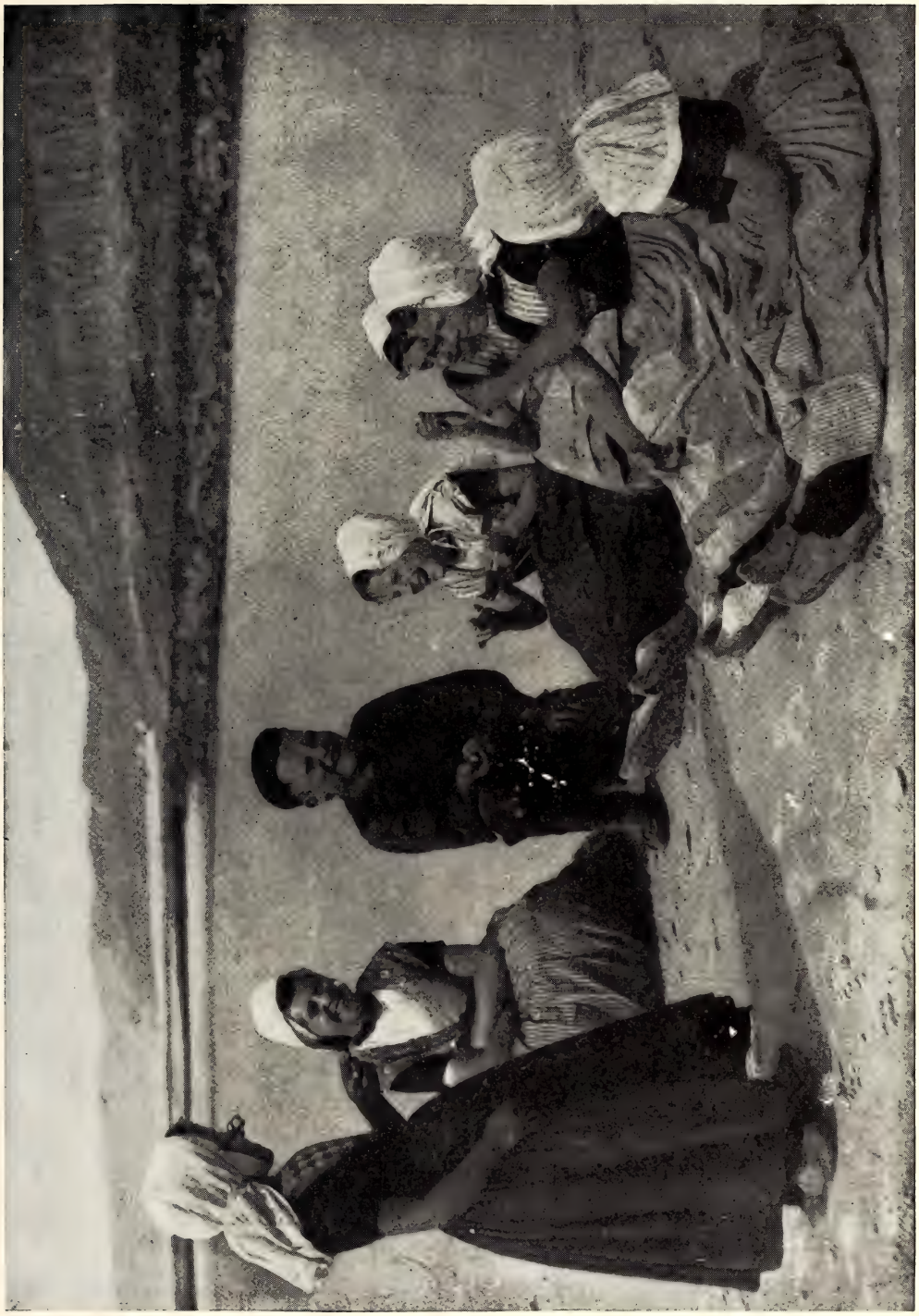
The island of Walcheren was the scene of one of the greatest disasters in British history. When the Earl of Chatham was driven out of Holland, after the invasion of the summer of 1809, he left 15,000 troops on Walcheren. More than one-half of them perished here from swamp fever before relief came in December, and half of the remainder were permanently disabled. All the photographs given on pages 1054-1066 were taken in the province of Zealand, whose inhabitants still retain many quaint and archaic peculiarities of dress, and speak the variety of Dutch known as Low Frankish.

BUSY CHILDREN OF WALCHEREN Photo from Hugh M. Smith

Photo from Hugh M. Smith

A FARM ON THE ISLAND OF WALCHEREN

The island is protected from the sea by dunes and dikes, and is very fertile



MIMICKING THE TEACHER: WALCHEREN

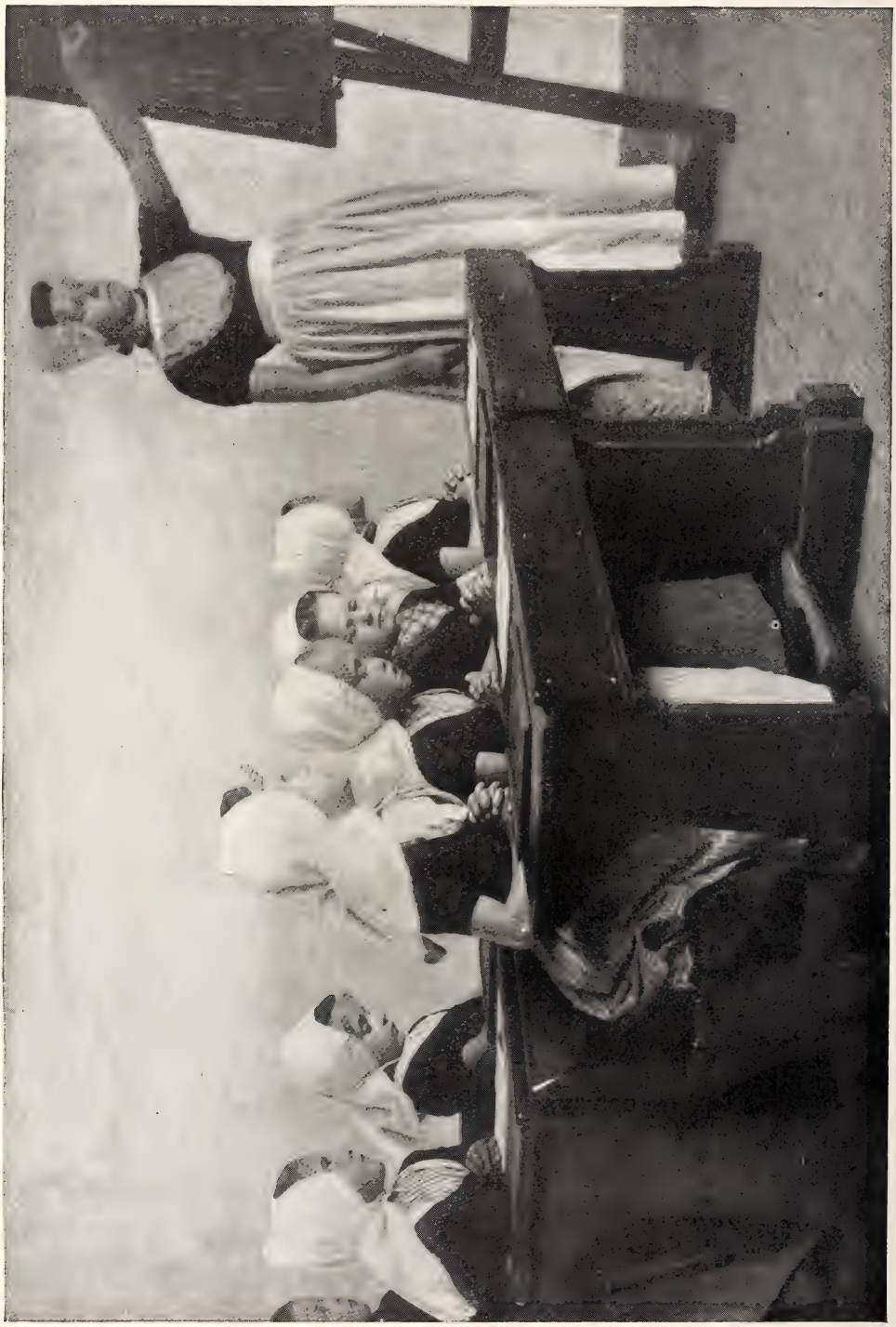
Photo from Hugh M. Smith

Photo from Hugh M. Smith

ON THE BEACH : WALCHEREN

CHILDREN PLAYING ON THE BEACH: WALCHEREN

Photo from Hugh M. Smith



A SCHOOL AT DOMBURG, WALCHEREN

Photo from Hugh M. Smith

WALCHEREN CHILDREN AND THEIR WOODEN SHOES

Photo from Hugh M. Smith

ZANTELANDE CHURCH : WALCHEREN

Photo from Hugh M. Smith

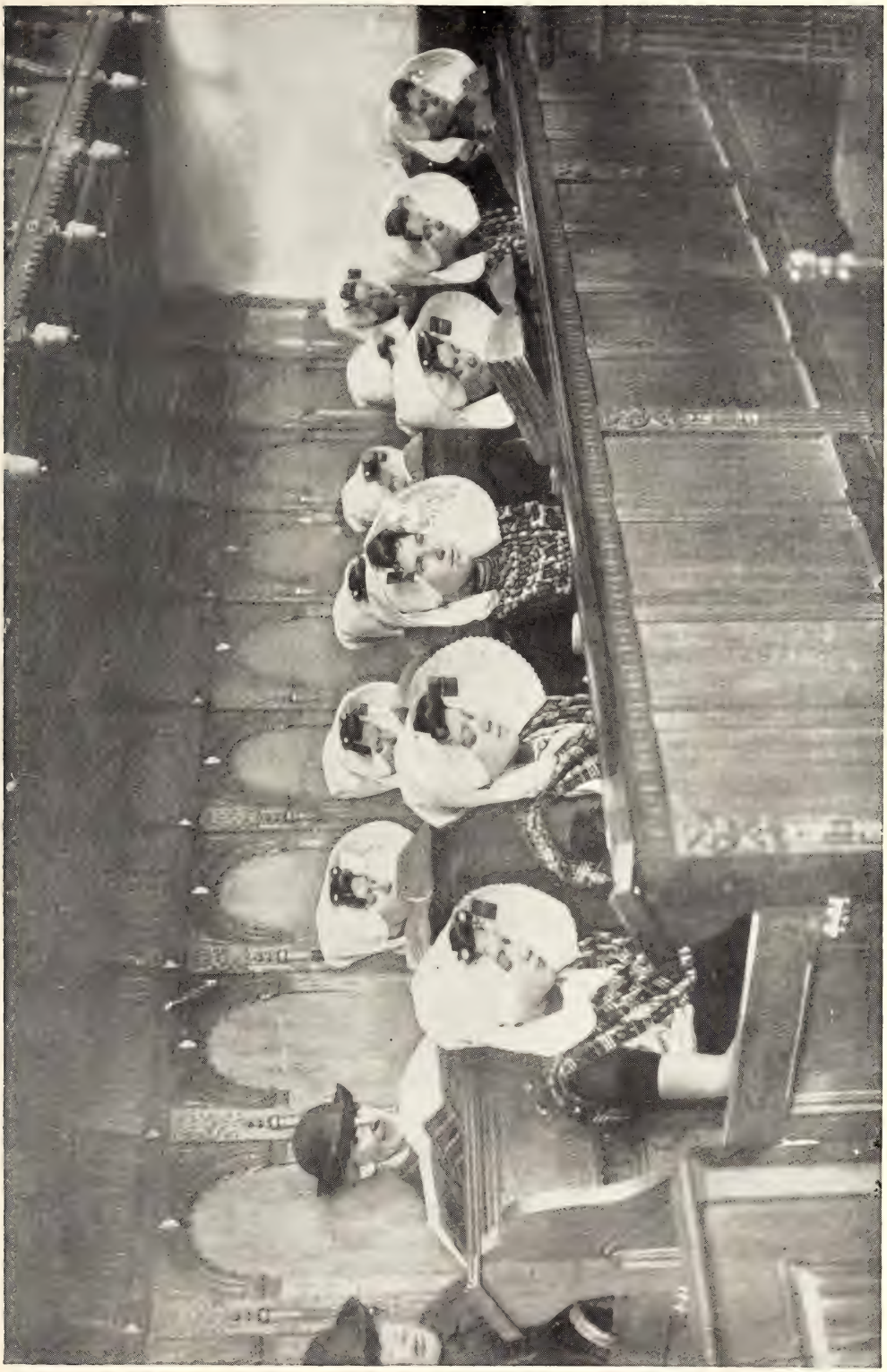


Photo from Hugh M. Smith

CHURCH INTERIOR: SOUTH BEVELAND

MARKET PLACE AT MIDDELBURG, THE CAPITAL OF WALCHEREN Photo from Hugh M. Smith

Photo from Hugh M. Smith

CHILDREN OF SOUTH BEVELAND, AN ISLAND ADJACENT TO WALCHEREN

These two islands form part of the province of Zealand, the greater portion of whose surface is below the level of the sea. The province is protected by more than 300 miles of dikes

mediately the market is in full blast. Sales are not made according to the summary "Dutch auction" fashion, but after much sparring and bargaining, during which the cheeses are felt, smelt, and tasted. Agreement upon the price for particular lots of cheese is signalized by seller and buyer striking hands, and then,

Photo from Hugh M. Smith

ANOTHER VIEW OF THREE OF THE CHILDREN SHOWN IN THE PRECEDING GROUP

the half hour having sounded, the "Kaasdragers" begin their labors, carrying to the weigh-house heaping loads of cheeses on sledlike trays suspended from their shoulders, receiving a check from the master of the scales, and returning their certified fares to the respective owners, who now have a basis for determining the aggregate weight and value of each lot as sold.

The selling and weighing proceed with such expedition that by 11 o'clock the market is practically over, and the removal of the cheeses to the warehouses of the purchasing merchants begins. Soon thereafter the country people depart in their wagons and boats, and when the carillon gives its grand noonday performance the market exists only as a memory.

On the occasion shown in the accompanying photographs nearly a hundred different manufacturers were represented, and the number of cheeses displayed on the ground and disposed of during the market hour was about 100,000.

AN IDEAL FUEL MANUFACTURED OUT OF WASTE PRODUCTS

The American Coal Briquetting Industry

By Guy Elliott Mitchell

HOW perfectly formed some of the hills of that range are, lying just to the left of the railroad. They look symmetrical enough to be artificial."

"Well, they do, for a fact. To tell you the truth, they are. They were made by men."

"Made by men? Mound-builders? Why, there are dozens of them; those abrupt slopes are hundreds, almost thousands of feet long—a regular mountain chain."

"True, and they are uniformly the most valuable mountains in existence; but they are, indeed, man-made; at the same time they are waste. They are mountains of solid carbon—coal dust—culm and slack from the mines—millions of tons of it."

More than one traveler has remarked thus on the huge coal-dust hills which break the skyline of the various coal-mining regions. Last year the coal mined in the United States was 445,000,000 tons; but in the process of mining

A HILL CONTAINING THOUSANDS OF TONS OF ANTHRACITE COAL WASTE, OR REJECTED CULM: SCRANTON, PENNSYLVANIA

Probably 200,000,000 tons of anthracite, worth $200,000,000, were lost last year as dust and waste, which, if converted into briquets, as in Germany or France, could have been profitably used. The heating value of this coal dust is even greater than that of the marketed coal. Billions of dollars have been thus wasted in the United States since coal mining began.

about 40 per cent of the deposits, or about 300,000,000 tons additional, was wasted, and a good proportion of this is represented by coal dust—culm, or slack, as it is called. Most of it is waste; it is either dumped back into the mines as "filling," or it is burned to get rid of it. The amount of such waste since coal-mining began in the United States can be stated only in billions of tons. And the heating value of this coal dust is even greater than that of the marketed coal.

BRIQUETTING AN IMPORTANT EUROPEAN INDUSTRY

In Europe no such destruction occurs. The coal dust is pressed up into briquets, which make a higher grade fuel than the run-of-mine coal. Germany manufactures 17,000,000 or 18,000,000 tons a year of briquets from coal waste—the highest grade fuel she produces. In the United States briquets could be made at the coal-dust piles, from either hard or soft coal, superior to any lump coal, and sold at the mines at a cost of about $1.25 a ton. Yet we pay for our household coal, not so good, from $5 to $8 a ton. Of course the transportation item, either in coal or briquets, is always the greatest cost factor.

But some of us will yet see the coal briquet in common use in this country. It has already gained a foothold, and, as Edward W. Parker, of the Mineral Resources Division of the Geological Survey, says, it is only a matter of time and education when the briquet will come into general use. There is, he remarks, a plethora of raw material which can be made into briquets, and in the utilization of which one of the greatest steps in the application of conservation principles can be made. In "Mineral Resources" for 1908, Mr Parker made the optimistic statement that the preliminary period of failure and discouragement in the manufacture and use of briquet fuel had apparently passed, and that the industry would soon find itself on a substantial footing. In his last report he notes a marked increase—55 per cent—in the annual production, although the industry is still in its infancy.

However, the output for 1909 was 139,661 tons, valued at $452,697. As many of these briquets were manufactured practically at the point of consumption, this value represents in large measure transportation charges. When comparisons are drawn between the extensive development of the briquetting industry in Europe and the small beginnings in this country, it must be kept in mind that in foreign countries the raw fuel is relatively high-priced. In Germany, where the briquetting industry has been most highly developed, raw coal is not only more expensive, but also of lower grade than the coal of the United States. Mr Parker gives three principal reasons for the holding back of our briquetting industry: first, our large supply of cheap fuel; second, the higher cost of our labor, and third, attempts to exploit secret processes for briquet-making, under which extraordinary claims are made, but which have not proved successful in commercial operation.

The greatest cost of the briquet lies in the binder which must be used to cement the coal dust together. The cost of manufacture should be about 40 cents a ton, but the cost of adequate binding material runs as high and higher than 75 cents for a ton of briquets produced. With asphaltum residuum of the heavier petroleums, water-gas tar pitch and ordinary coal-tar pitch, all excellent binders, available for briquet manufacture, there is no reason for secrecy with regard to the constituency of patented binders.

BRIQUETS MAKE IDEAL FUEL

Briquets make splendid fuel, but the people know little of them. The better educated the public becomes in the use of briquetted fuel the more rapidly will the industry develop, the most pronounced retarding element having been the tendency to exploit secret methods of questionable merit instead of progressing along conservative lines in paths laid out by the experience of European countries. The history of the briquet industry in Europe reveals the fact that every conceivable substance having any claim as a bond has been tried. After practical

LARGE BRIQUET PILES ON A FRENCH RAILWAY: ALSO A PILE OF EGGETTES USED FOR DOMESTIC FUEL

Locomotives which burn briquets emit less smoke, consume less fuel, and attain greater speed than when fed by run-of-mine coal of the best quality

experience, the consensus of opinion has given preference to pitch made from oil or coal-tar. This tar is a by-product obtained in the manufacture of coke in by-product ovens and in the manufacture of gas, either from the destructive distillation of coal or by carburetting water-gas with oil.

Measured in percentages, our briquet production is but an infinitesimal part of our entire fuel production; yet it constitutes the very cream, for the briquet is the fuel ideal, and, as its superiority over raw coal becomes better recognized, the demand for it will force the utilization of today's mine waste. In speaking of the commercial future of the briquet, Mr C. T. Malcolmson, a mining engineer, says in a recent issue of the "Black Diamond":

"If the conservation of natural resources is to pass from the period of agitation to one productive of practical results, the briquetting of coal is one solution of the waste. The agitation for the reduction in smoke is another factor assisting this new industry. We cannot hope to take the high-volatile coals mined in Illinois and make of them, by treatment, a fuel which will be smokeless in burning under all conditions, but there are high-grade, low-volatile coals sold in the Chicago market which, if briquetted, will make a smokeless fuel.

"As a rule these high-grade, low-volatile coals are friable, and the lump coal slacks if exposed.

"The United States government has demonstrated that briquets made from these coals withstand the action of the

SOME OF THE VARIOUS TYPES OF FOREIGN BRIQUETS

Briquets range in size from little fellows no larger than a small hen's egg, intended for domestic use, to blocks considerably larger than an ordinary building brick

weather for almost an indefinite period. Briquets do not deteriorate, either in physical quality or in heat value, in being stored for several years in the open. A briquetting plant established at the mines will allow an operator to produce coal to the maximum of his lump-coal requirement and briquet such of the fine coal as does not find a ready sale. These briquets can be stored and shipped when coal cars are idle to some common distributing point, there to be held in storage until the price warrants their sale."

REMARKABLE RESULTS FROM GOVERNMENT EXPERIMENTS

The government's experiments and investigations with reference to briquets, like other phases of its fuel inquiries, have been productive of astonishing results. Based on these tests made by the Geological Survey and now being continued by the new Bureau of Mines, briquetted coal, for use at least by railway locomotives and steamships, has a bright future. Briquets are shown to have produced greatly increased energy, and, under forced drafts, proved themselves much more nearly smokeless than run-of-mine coal of the best quality. It has, indeed, been confidently predicted that the war vessel of the future will have its smoke problem solved as effectually as has been the smoke question on the firing line since the introduction of smokeless gunpowder.

In 16 comparative test trips on the Atlantic Coast Line Railroad, made under the supervision of the Geological Survey, aggregating 1,984 miles, briquets proved superior on every count. Ton for ton, the briquets ran the cars more miles than did the coal, and ran them faster. The following figures tell the tale:

	Pounds consumed	Car miles run
Briquets	161,980	12,896
Coal	172,700	10,912

Stated another way, it required, to run each car mile, 15.8 pounds of coal, but

only 12.5 pounds of briquets. With briquets employed as fuel on all the railroads of the United States, this would mean a saving of at least 30,000,000 tons of coal annually. The most impressive showing for the briquets, however, lay in the fact that it was possible to secure from them a much hotter fire and consequently greater speed than with coal, and, in these particular practical tests, to make up much lost time. This showing of increased speed is significant in these days when entire railroad routes are being retracked to cut out curves and shorten distances in order to establish faster schedules.

Further U. S. Geological Survey tests, made on Chesapeake and Ohio Railroad engines, showed that the briquet ignited more freely than coal, and therefore got up steam quicker. It made an abnormally hot fire, and, with the engine running at high speed, emitted practically no smoke. A heavy fire could be maintained without danger of clinkering, few ashes resulted in the fire-box, and the cinder deposit was very small, thus indicating almost complete combustion. Incidentally, this would suggest that if railroads burned briquets, fewer if any live coals and cinders would be belched from the engine's smokestacks to start forest fires and cause the destruction of thousands of acres of timber lands every year.

IN EVERY RESPECT SUPERIOR TO COAL

In still further government tests, made in coöperation with the Missouri Pacific, the Michigan Central, the Rock Island, the Burlington, and the Chicago & Eastern Illinois railroads—aggregating 100 locomotive tests—briquets, in almost every instance, showed greater efficiency than natural coal. Certain Oklahoma coal, for instance, gave a boiler efficiency of 59 per cent, but briquets made from the same coal gave an efficiency of from 65 to 67 per cent. Decreased smoke density, the elimination of clinkers, and the apparent decrease in quantity of cinders and sparks are cited as the chief reasons for this higher efficiency—factors which should be interesting to the public as well as to the railroad companies' exchequers.

Other interesting tests were carried on by the Survey with a locomotive mounted at the testing plant of the Pennsylvania Railway Company at Altoona, Pennsylvania, resulting in the same story—favorable to the briquet. In the report on these experiments the following conclusions have been published by the government:

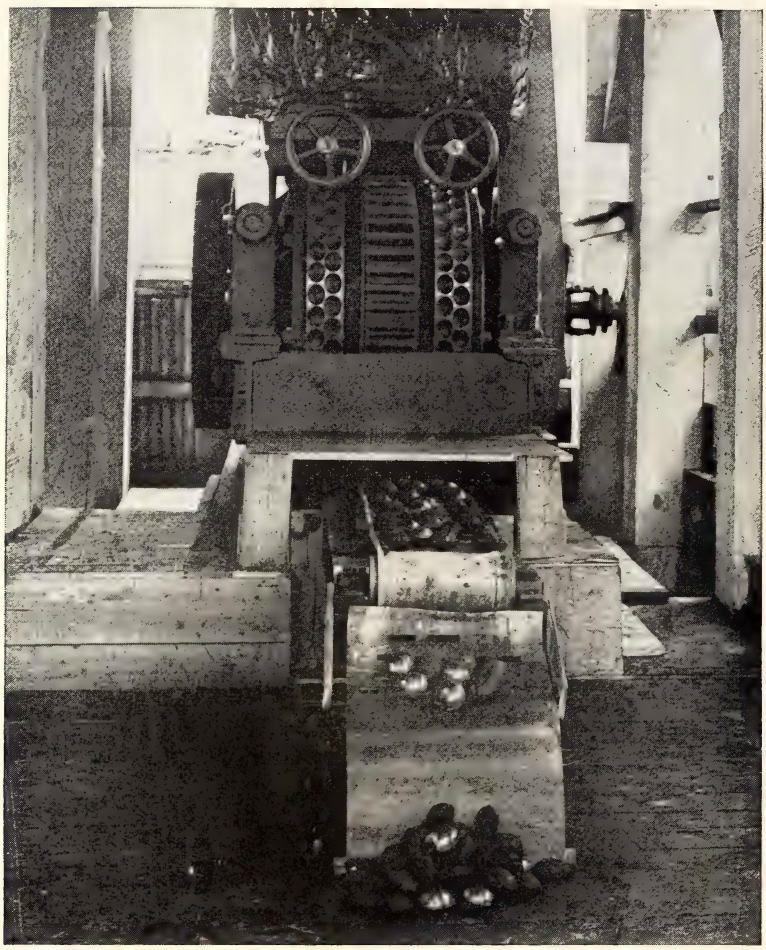
"The briquets made on the government machines have well withstood exposure to the weather and have suffered but little deterioration from handling. In all classes of service involved by the experiments the use of briquets in the place of natural coal appears to have increased the evaporative efficiency of the boilers tested. The use of briquets increases the facility with which an even fire over the whole area of the grate may be maintained. In locomotive service the substitution of briquets for coal has resulted in a marked increase in efficiency, in an increase in boiler capacity, and in a decrease in the production of smoke."

It is especially noted that the briquet, on account of its lack of smoke, may be used to advantage in running in and out of cities. In certain of the tests, for instance, the figures show an average density of smoke for coal stated at 1.7, as against but .62 for briquets.

Similar tests were carried out on the torpedo boat destroyer *Biddle,* with a very great increase in boiler capacity resulting from the use of briquets, which made a much hotter fire than had ever been possible with coal. Never before had the *Biddle* run so fast as during these briquet tests.

BRIQUETS EXTENSIVELY USED ABROAD

In a personal investigation of the briquet industry in European countries, Dr. J. A. Holmes, the present Director of the Bureau of Mines, found this form of fuel in high favor. In Belgium he found that the state railroads used briquets exclusively for passenger service. In Germany the briquet constitutes a



A BRIQUET MACHINE IN THE BUREAU OF MINES PLANT

At this station coal dust is made into briquets by enormous pressure, without the use of any binding material

fuel which, it is stated, can be handled and stored with greater facility and less loss than natural coal; as a steam producer it is most satisfactory and its use conserves the country's resources. In France Doctor Holmes found the briquet being widely used and purchased by the government railroads under definite specifications. The absence of smoke and cinders in traveling on these briquet-using trains was noticeably agreeable.

The Red Star Line steamships, according to a statement in the "Black Diamond," use bituminous briquets from Antwerp to New York, but on the return trip have to burn American soft coal. The opportunity presented for practical comparative tests is an ideal one. From reports on both classes of fuel, better time and at lower cost is made when running on briquets; it is estimated that "nearly one-third of the average coal bill is saved."

OUTLOOK GOOD FOR AMERICAN BRIQUET-MAKING

The conditions in the United States would seem to favor the gradual and

steady advance in briquet-making. The supply of the raw material—coal screenings—is a great and constant one, and the possible supply of binding material is good. Our annual coke production is now about 35,000,000 tons, and an important by-product of coke manufacture is coal-tar, an ideal briquet binder. Until recently most of our coke was made in "beehive" ovens, by which process the by-products are entirely wasted. Great by-product coke ore retorts are now rapidly displacing the wasteful beehives, a recent notable installation being at the United States Steel Corporation's huge plant at Gary, Indiana, and thus large quantities of cheap binding material are becoming available. Moreover, the binder manufacturers and the briquetting industry are showing signs of "getting together." Briquetting Engineer Malcolmson stated recently, in discussing the importance of binding material for briquet manufacture:

"There is no doubt that the successful briquetting of coal depends as much on the specifications and uniformity of the binder furnished as it does on the mechanical operations of the machinery. The consumption of pitch for briquetting purposes so far, in this country, has been so irregular and uncertain that pitch manufacturers have not been disposed to give the distillation of tar the proper consideration. In working out the problems which are always inherent in new propositions, it has been discovered that the ability to put on the market a uniform fuel necessitated a uniform quality of binder. One of the most promising indications of future success in establishing this important industry in the United States is the attitude which has recently been assumed by the leading pitch manufacturers in recognizing the necessity of a distinct product to be known as "briquetting pitch." These manufacturers also recognize the necessity of assisting in every way to establish the briquetting industry by not only spending considerable money in developing a pitch of the requisite specifications, but also placing that pitch on the market at a price which will make the briquetting of coal commercially possible.

A NUMBER OF BRIQUET PLANTS IN PRACTICAL OPERATION

In Mineral Resources for last year, Mr. Parker, of the United States Geological Survey, describes the briquetting plants in active operation. The plants are located in New York, Pennsylvania, Massachusetts, Rhode Island, Indiana, Illinois, Michigan, Iowa, Missouri, Oklahoma, Montana, Washington, Oregon, Texas, and Wisconsin.

The briquets range in size from little fellows no larger than a small hen's egg, intended for domestic use, to blocks considerably larger than an ordinary building brick. They are variously termed "boulets," "eggettes," "carbonets," "patent fuel," "coalettes," and "briquets." The briquet machines have capacities ranging from a few tons to 40 or more tons per hour. The coal or slack is finely crushed and then mixed with the pitch or binder like a pudding, superheated and saturated steam and water being used to obtain a conglomerate of the right consistency, varying with different coals. The material is then forced into the molds and subjected to a heavy pressure of a ton or more to the square inch. Thereupon issues the completed briquet.

HUGE LIGNITE BRIQUETTING MACHINE

A statement of the possibilities of the briquet industry in the United States would not be complete without reference to the promising lignite briquetting experiments being carried on by the Bureau of Mines. At the Pittsburg station of this bureau there has been installed a huge German briquet machine, in which briquets are made by enormous pressure, without the use of binders. The machine develops a pressure capacity of from 14,000 to 28,000 pounds per square inch, and is typical of the plants used in Germany with great success for briquetting brown coal. Tests have already been made with Texas, North Dakota, and California lignites in order to determine

whether the vast stores of American lignites cannot be briquetted without the use of artificial binders, under the same conditions as prevail in Germany for briquetting brown coal, which is analogous to our lignite. The results from these preliminary tests have been in the main highly satisfactory.

The tests proved that not only can lignite be briquetted, but that the reduction of the moisture incident to the briquetting process increases the heat value of the briquets obtained by from 37 per cent to 54 per cent over that of the raw fuel. This improvement in heat value will be of great importance to a consumer, as a greater efficiency is obtained from the combustion of fuels of high-heat value than from those of lower-heat value. The experiments have also conclusively demonstrated that the briquetted fuel withstands the effect of weathering several months longer than the raw fuel, thus making possible the transportation of the lignite briquets, which is not practicable in the raw fuel, owing to its tendency to crumble and slack.

As a whole, the coal-briquetting industry in the United States gives promise of a fine development in the near future; it should give us a fuel of the greatest value and convenience for both industrial and domestic uses, and there is satisfaction in the knowledge that whatever the growth of the briquet production it means in effect the creation of something out of nothing, since the materials which constitute this fuel are at present a dead waste.

NATIONAL GEOGRAPHIC SOCIETY

THE series of illustrations in color published in the November number of this Magazine has proved so popular that a similar series will be published at least twice in 1911. The next number will contain the address recently delivered before the Society by ex-President Roosevelt, illustrated by many photographs by Mr Kermit Roosevelt. The same number will also contain an unusual series of photographs, showing the immense work being done on the Panama Canal.

The annual dinner of the Society will be held Saturday evening, January 14, at the New Willard. The dinner is in honor of the U. S. Army and of the art of aviation. The principal guests of honor will be Messrs Wilbur and Orville Wright. There will be addresses by President Taft, the German Ambassador, the Mexican Ambassador, Major General Leonard Wood, Chief of Staff U. S. Army, and Mr Wilbur Wright. Members desiring to attend should send their applications at once. Price per plate, $5.00.

January 6.—"Arab Life in Tunisia." By Frank Edward Johnson.

January 13.—Annual Meeting, Hubbard Memorial Hall, 5 p. m.

January 13.—"The Methods, the Achievements, and the Character of the Japanese." By Mr George Kennan. Illustrated.

January 20.—"Making Pictures. The Wonderful Development of the Art of Photography and Its Value to Education and Commerce." By Hon. O. P. Austin, Chief of the United States Bureau of Statistics and Secretary of the National Geographic Society. Illustrated with motion pictures.

January 27.—"The Panama Canal." By Col. George W. Goethals, Chief Engineer Panama Canal. Illustrated.

February 3.—"Our Plant Immigrants." By Mr David Fairchild, in charge of Agricultural Explorations of the Department of Agriculture.

February 10.—"The Balkan States." By Mr E. M. Newman. With motion pictures.

February 17.—"The Heart of Turkestan." By Mr William E. Curtis. Illustrated.

February 24.—"The Italy of Today." By Maj. Gen. A. W. Greely, U. S. Army.

March 3.—"The Birds of Mexico." By Mr Frank M. Chapman, of the American Museum of Natural History.

March 10.—"From the Amazon to the Orinoco. The Five Guianas." By Mrs Harriet Chalmers Adams. With motion pictures.

March 17.—"Travels and Experiences in Mexico." By Mr John Birkinbine, President of the American Institute of Mining Engineers. Illustrated.

March 24.—"The Shrines of Greece: Olympia, Delphi, Eleusis, Athens, Mycenæ, Tiryns, Epidauros, and the Island of Crete." By Miss Marion Cock. Illustrated.

March 31.—"The Romance and Grandeur of Spain." By Dr Charles Upson Clark, of Yale University. Illustrated.

April 7.—It is hoped that former Vice-President Charles W. Fairbanks will be able to address the Society on this date on some subject connected with his recent journey around the world.

April 14.—"The Fiords and Fisheries of Norway." By Dr Hugh M. Smith, Deputy Commissioner of the Bureau of Fisheries. With motion pictures.

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